# Record of Decision

Northwest Pipe and Casing Company / Hall Process Company
Soil Operable Unit (OU 1)

Clackamas County, Oregon

June 2000

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# DECLARATION OF THE RECORD OF DECISION

## SITE NAME AND LOCATION

Northwest Pipe and Casing Company / Hall Process Company
Soil Operable Unit (OU 1)
Clackamas County, Oregon

CERCLIS Identification Number: ORD 980988307

## STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected remedial action for the Soil Operable Unit (OU) for the Northwest Pipe and Casing Company / Hall Process Company Site (NWPC), located at 9571 SE Mather Road in Clackamas, Oregon. This Record of Decision (ROD) has been developed in accordance with the requirements of Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) of 1980, 42 USC §9601 *et seq*. (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision is based on the Administrative Record for the Site.

The soil remedy was selected by the U.S. Environmental Protection Agency. The State of Oregon concurs with the selected soil remedy.

## ASSESSMENT OF THE SITE

The Northwest Pipe and Casing Company / Hall Process Company site is located in Clackamas, Oregon and covers approximately 53 acres of land.

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

## DESCRIPTION OF THE SELECTED REMEDY

The selected remedy for the Soil OU addresses contaminated soil and debris at the site. At a future date, EPA will issue a separate ROD to address contaminated groundwater (OU 2). Further investigation is needed to characterize the extent of groundwater contamination before a groundwater ROD can be issued.

The cleanup strategy for soil at the site will address the soil principal threats through source control, treatment and off-site landfill disposal. The most-highly contaminated soils will be excavated and removed from the site. Most of the removed highly-contaminated soil will be treated off-site and some will be disposed in an off-site landfill without treatment. Low-level threats at the site, which includes the lesser-contaminated soil and the thermally-treated soil returned to the site,

will be contained by the placement of a cap over the site.

The major components of the selected remedy for the soil OU include:

- Removal and off-site disposal of Parcel B structures and features including subsurface piping, in-ground structure at Plant 3, underground storage tanks (USTs), aboveground tank with coal tar and metal bins containing refuse, soil piles 3 and 4, and drums of investigation-derived waste (IDW) soil.

- Excavation of Parcel B soil exceeding Oregon Hot Spots levels and transportation to either 1) an off-site thermal treatment facility for thermal desorption, or 2) a landfill for disposal, if the soil contains PCBs greater than 50 mg/kg (parts per million), the maximum level allowed by the thermal treatment facility's permit;

- Return of the thermally-treated soil to the site for placement as backfill in the excavated areas;

- Placement of a two-foot thick, clean soil cap over Parcel B;

- Construction of a surface water drainage system for Parcel B, if needed;

- Erosion control actions during remedy construction to minimize impacts to surface water quality and critical habitat of federally listed threatened or endangered anadromous fish.

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- Implementation of institutional controls to limit human exposure to and warn of the hazards associated with chemicals of concern (COCs) in the soil underlying the cap on Parcel B, through the use of a restrictive covenant which will run with the land and a deed notice;

- Long-term monitoring, inspections and maintenance of the site cap to ensure it remains protective.

EPA will conduct further investigation on Parcel A to locate a suspected source of VOC groundwater contamination. Contaminated soil on Parcel A with COC concentrations exceeding the Oregon Hot Spots levels will be remediated using the selected remedy.

**STATUTORY DETERMINATIONS**

The selected remedy for the soil OU is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate for the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy utilizes permanent solutions and alternative treatment technologies to the extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces

toxicity, mobility, or volume as a principal element.

Because this remedy will result in hazardous substances remaining above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action(and at 5-year intervals thereafter) to ensure that the remedy continues to provide adequate protection of human health and the environment.

**DATA CERTIFICATION CHECKLIST**

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for this site.

- **!** Chemicals of concern (COCs) and their respective concentrations. (See Section 5.6)
- **!** Baseline risk represented by the COCs. (See Sections 6.3.4.3 and 6.4.6)
- **!** Cleanup levels established for COCs and the basis for these levels. (See Section 7.2)
- **!** How the source materials constituting principal threats are addressed. (See Section 11.6)
- **!** Current and reasonably anticipated future land use assumptions used in the baseline risk assessment and ROD. (See Section 6.2)
- **!** Potential land uses that will be available at the site as a result of the selected remedy. (See Section 10.4)
- **!** Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected. (See Section 10.3)
- **!** Key factors that led to selecting the remedy. (See Section 10.1 )

Chuck Clarke Date
Regional Administrator, Region 10
United States Environmental Protection Agency

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## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ARAR | applicable or relevant and appropriate requirement |
| bgs | below ground surface |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 |
| COC | chemical of concern |
| CT | central tendency |
| DCE | dichloroethene |
| DEQ | Oregon Department of Environmental Quality |
| DNAPL | dense non-aqueous phase liquids |
| EPA | U.S. Environmental Protection Agency |
| EPC | exposure point concentration |
| FS | feasibility study |
| FWQC | Federal Water Quality Criteria |
| HI | hazard index |
| HPAH | high molecular weight polynuclear aromatic hydrocarbon |
| IRIS | Integrated Risk Information System |
| L | liter |
| MCL | maximum contaminant level |
| Fg | microgram |
| mg/kg | milligrams per kilogram |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NPL | National Priorities List |
| O&M | Operation and Maintenance |
| PAH | Polynuclear aromatic hydrocarbon |
| PCB | Polychlorinated biphenyls |
| PCE | tetrachloroethene |
| PRG | preliminary remedial goal |
| PRP | potentially responsible parties |
| RAO | remedial action objective |
| RCRA | Resource Conservation and Recovery Act |
| RfD | reference dose |
| RG | remediation goal |
| RI | remedial investigation |
| RME | reasonable maximum exposure |
| ROD | record of decision |
| SARA | Superfund Amendments and Reauthorization Act of 1986 |
| SF | slope factor |
| TCE | trichloroethene |
| TSCA | Toxic Solutions Control Act |
| UCL | upper confidence limit |
| VOC | volatile organic compound |

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# DECISION SUMMARY

## INTRODUCTION

This Decision Summary provides a description of the site-specific factors and analyses that led to selection of the soil remedy for the Northwest Pipe and Casing / Hall Process Company Superfund Site (Site). It includes information about the Site background, the nature and extent of contamination, the assessment of human health and environmental risks, and the identification and evaluation of remedial alternatives.

The Decision Summary also describes the involvement of the public throughout the process, along with the environmental programs and regulations that may relate to or affect the alternatives. The Decision Summary concludes with a description of the selected remedy in this Record of Decision (ROD), and a discussion of how the selected remedy meets the requirements of the Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

Documents supporting this Decision Summary are included in the Administrative Record for the Site. Key documents include the Final Remedial Investigation Report, the Final Feasibility Study Report, the Human Health and Ecological Baseline Risk Assessment Report and the Proposed Plan for the Site.

This Site is divided into two operable units, OU1 for soil and OU 2 for groundwater. This ROD is for the OU1, the soil operable unit. The designation of operable units for response actions is discussed in Section 4.

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# 1.0 SITE NAME, LOCATION, DESCRIPTION AND HISTORY

## 1.1 SITE NAME, LOCATION AND DESCRIPTION

The Northwest Pipe and Casing Company / Hall Process Company site lies within the lower Williamette River basin of western Oregon, in a north-south trending valley between Mount Talbert to the east and a low bluff to the west. The site is located between SE Lawnfield and SE Mather Roads in Clackamas County, Oregon (**Figure 1-1**), and is approximately twenty miles southeast of Portland. The CERCLIS ID number for this site is ORD 980988307. The site is adjacent to Southern Pacific Railroad tracks and approximately one-half mile east of Interstate Highway 205.

The U.S. Environmental Protection Agency is the lead agency and the Oregon Department of Environmental Quality is the support agency. The remedial and removal actions described in this ROD have been and will be conducted by EPA utilizing the Superfund trust fund. EPA has reached settlements with responsible parties, which include the payment of some funds to EPA and the State for use in responding to contamination at the site. The state of Oregon has provided support concerning state of Oregon cleanup requirements.

The site is located in a mixed commercial and light industrial district. The Camp Withycombe Air National Guard facility is located to the immediate southeast of the site. Adjacent businesses to the east along Mather Road include several metal salvage and related operations and a truck manufacturing facility. Property immediately east of the site, formerly an automobile junkyard, is currently vacant. A small residential community known as Hollywood Gardens is located to the south of Camp Withycombe. The bluff west of the site is occupied by a collection of retail and commercial businesses concentrated along SE 82nd Avenue, including restaurants, motels, gas stations, stores and an elementary school.

The site covers approximately 53 acres of land. For purposes of EPA's site investigation , the site was divided into two parts, Parcel A (21 acres) and Parcel B (32 acres), based on historical uses of the properties (**Figure 1-2**).

The valley in which the site is located is drained by Dean and Mount Scott Creeks, which flow to the north-northwest and eventually flow into the Williamette River. The site is relatively flat. Standing water on Parcel B is common during the rainy season, as a result of poor drainage. Surface drainage from Parcel A is largely contained in storm drains. Surface water runoff from Parcels A and B drains into manmade ditches along the east and west boundaries of the site, subsequently draining into Dean Creek (**Figure 1-3**).

## 1.2 SITE HISTORY

Beginning in 1967 and lasting until operations ceased in 1985, Northwest Pipe and Casing Company (NWPC) manufactured and stored steel pipe on Parcel A. Beginning in 1956, Hall

Process Company (HPC) operated a pipe-coating facility on Parcel B. In 1978, HPC ceased operations and the pipe-coating facility on Parcel B was leased to NWPC, which continued pipe-coating until 1985.

Pipe coating operations involved sandblasting pipe with steel shot, spraying the pipes with primer, and applying the coating material. Coal tar, coal tar epoxy, asphalt, polyethylene epoxy, and concrete were used as coating materials. A volatile-organic based primer was used to adhere pipe coatings and solvents were used in the maintenance of pipe-coating equipment.

The majority of coal tar coating took place in and around former Plants 3 and 4 on Parcel B; less pipe coating occurred at Plant 2, while polyethylene epoxy coating occurred in Plant 1. Coal tar was brought to the site in solidified form and then heated to liquify it prior to use. Several underground tanks on Parcel B were used to store fuel and possibly waste oil. On Parcel A some used solvents, oil and water mixtures and metal filings were disposed of directly on the ground. Wastes from the pipe-coating operations were also disposed at various locations on Parcel B by burial, dumping, burning and spreading. These wastes included used solvents from maintenance activities, primers, excess coating material (coal tar), coating product containers, condensed coal tar residues and oils, pipe trimmings, and engine and hydraulic oils. Leaks and spills from equipment and containers also occurred on Parcel B.

Historical, on-site disposal and mishandling of wastes from pipe manufacturing and pipe coating operations are the primary sources of contamination at the site. Soil at the site is contaminated with PAHs and PCBs. Coal tar used for coating pipes was the main source of PAH contamination of the soils. PCBs in the soil most likely originated from cutting oils, hydraulic oils, cooling oils, and/or electrical transformers used at the site. PCB-contaminated oils may have been used for on-site dust suppression based on their widespread detection in shallow soils.

DEQ conducted a preliminary assessment of the site in 1987. Following unsuccessful attempts by DEQ to have potentially responsible parties undertake remedial investigations, in 1989 and 1990 EPA conducted a Preliminary site Inspection and a Listing site Inspection respectively.
EPA placed the Northwest Pipe and Casing Company site on Superfund National Priorities List on October 14, 1992. EPA initiated a Remedial Investigation and Feasibility Study in 1996 and conducted a baseline risk assessment in 1998.

A CERCLA removal action, consisting of perimeter fencing, warning signs, demolition of vacant buildings and off-site disposal of demolition debris was conducted on Parcel B in 1993. The removal action was taken to restrict exposure of trespassers or transients to site contaminants. Approximately 230 tons of surface debris -- coal tar, abandoned car tires and batteries, were removed from Parcel B in 1997 prior to the Remedial Investigation. Two underground storage tanks (USTs) were removed from Parcel B in 1998. Site security patrols on Parcel B were started in 1999 to combat recurring transient trespass on the site.

The Oregon Department of Transportation (ODOT) has owned the western part of Parcel A since

1985 and used it for equipment yard and warehouse/office. The eastern lot of Parcel A has been owned by Northwest Development Corporation since 1985 and is occupied by three low-rise buildings housing commercial businesses.

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## 2.0 SITE ENFORCEMENT ACTIVITIES

The EPA conducted previous investigations at the site in 1988 through 1990. The results of these investigations are contained in the *Site Inspection Report, December 1988* and the *Listing Site Inspection Report*, June 1990. Based on these investigations, EPA proposed the site for the National Priorities List (NPL) on February 7, 1992. The site was added to the NPL on October 14, 1992.

EPA issued special notices to potentially responsible parties in June 1995. These parties included: Northwest Pipe and Casing Company; Oregon Department of Transportation; Wayne Hall, Jr.; and Northwest Development Corporation. In 1997 and 1998, consent decrees between EPA and the State and these parties were entered in federal courts. The consent decrees include settlements with the parties pertaining to liability for past releases of hazardous substances, and include monetary payments to EPA and the State to be used for response activities. The consent decree with Mr. Hall also transferred ownership of Parcel B to DEQ, as trustee for EPA and DEQ.

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## 3.0 COMMUNITY RELATIONS

The Proposed Plan, Remedial Investigation Report, Feasibility Study Report, Human Health and Ecological Baseline Risk Assessment Report, as well as other technical and site-related documents were made available to the public in January 2000. They can be found in the Administrative Record file, which is located at the Clackamas County Library, Clackamas Corner Branch, located at 11750 SE 82nd Avenue, Suite D, Clackamas, Oregon, at the EPA, Oregon Operations Office, located at 811 SW Sixth Avenue, 3rd Floor, Portland, Oregon, and the Superfund Records Center, EPA Region 10, 1200 Sixth Avenue, Seattle, Washington.

An initial public comment period for the proposed plan was held from January 31 to February 29, 2000. The notice of availability of the proposed plan and opportunity to comment was published in the Oregonian on January 27, 2000. The proposed plan was mailed to all approximately 150 persons on EPA's mailing list for the site. A public meeting was held on February 8, 2000 to present the proposed plan to the public. At this meeting, representatives from EPA and DEQ answered questions about the site and the proposed plan. EPA extended the public comment period to March 31, 2000 based on requests from the public. EPA's response to the comments received during the public comment period is included in the Responsiveness Summary, which is a part of this Record of Decision.

Fact Sheets have been issued by EPA in 1992, 1993, 1997 and 1999, providing the public with information about the Superfund process and EPA activities at the site. A community relations plan for the site was prepared in 1992.

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# 4.0 SCOPE AND ROLE OF RESPONSE ACTION

This section describes the scope of the selected response action and its role within the overall site management strategy. Past response activities, response actions selected in this ROD, and future response plans are outlined.

## 4.1 Designation of Operable Units

The Northwest Pipe and Casing Company site involves multiple contamination problems. The Remedial Investigation conducted for the site identified contamination of soil, groundwater, surface water and sediments. For the purpose of managing the site-wide response actions, EPA has organized response actions for site contamination problems into two operable units (OUs):

- Operable Unit 1: Contamination of soils and debris
- Operable Unit 2: Contamination of groundwater

Further groundwater investigation is needed to fully characterize the extent of groundwater contamination before a ROD for groundwater can be issued. EPA projects that the groundwater ROD would be issued in 2001. However, there is sufficient information now on the soil contamination problem to allow issuance of a ROD for soil. Postponing the soil ROD until 2001 so that one ROD could be issued for all site contamination problems would cause a delay in achieving a significant reduction in site risk to human health. By dividing the site contamination problems into two operable units, necessary response actions for soil and groundwater can proceed independently as soon as they are ready.

EPA has determined that no response actions are needed for surface water and sediments. Contamination of these media does not present unacceptable risks to human health or the environment.

Designation of groundwater and soil operable units at the Northwest Pipe and Casing Company site is consistent with the National Contingency Plan which defines an OU as a discrete action that comprises an incremental step toward comprehensively addressing site problems.

## 4.2 Past Response Actions

Parcel B has been vacant and unoccupied since the late-1980s. Trespass by transients has been a recurring situation, because the vacant site was perceived as offering temporary shelter. The objective of past EPA response actions was to minimize the potential for people gaining access to Parcel B to have direct contact with surface contamination. EPA constructed a perimeter security fence with warning signs around Parcel B in 1993. Additionally, all former plant buildings on Parcel B were demolished through a CERCLA removal action. These buildings were being used by transients as temporary shelter. Demolition debris was removed for off-site disposal; metal debris from buildings was recycled off-site. Approximately 230 tons of surface debris -- coal tar chunks,

metal bins containing solidified coal tar, and abandoned car tires and batteries were removed from Parcel B in 1997. Two underground storage tanks (USTs) were removed from Parcel B in 1998. Security patrols were started in 1999 and have been successful in controlling transient access to the site.

## 4.3 Response Actions Selected in this ROD for Operable Unit 1

The actions selected in this ROD address Operable Unit 1, contaminated soil and debris on the site. Incidental activities included in OU 1 are: removal of additional Parcel B structures and features including subsurface piping, in-ground structure at Plant 3, underground storage tanks, aboveground tank with coal tar, soil piles 3 and 4, and drums of investigation-derived waste (IDW) soil. Direct contact with surface and subsurface soil poses a current and potential risk to human health of trespassers, construction workers and maintenance workers because EPA's acceptable risk range is exceeded**.** Soil on Parcel B of the site is contaminated with hazardous substances, including polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and to a lesser extent volatile organic compounds (VOCs).

The selected response action for contaminated soil will remove the most highly contaminated soil from the site. Most of the removed soil will be thermally treated, while some will be disposed in an off-site landfill without treatment. Excavations will be backfilled with treated soil meeting the remediation goals. A soil cap will be placed over Parcel B. The soil cap will be constructed after the soil excavation and backfilling are completed, unless EPA determines that construction of the groundwater remedy would compromise or interfere with the cap. In the later case, the cap placement may be delayed until after the groundwater remedy construction is completed.

Based on knowledge of the manufacturing activities which occurred on the site, EPA has determined that the contaminated soil and debris does not contain RCRA listed hazardous wastes. However, some of the soil on Parcel B may contain characteristic hazardous waste under RCRA, due to concentrations of tetrachloroethene (PCE) high enough to possibly cause the soil to fail the Toxicity Characteristic Leaching Procedure (TCLP) test. TCLP tests have not been performed yet on this soil at the site.

Prior to the start of remedial action, EPA will conduct additional soil testing. If the soil fails the TCLP test, the soil will be treated within an on-site Area of Contamination (AOC) to remove the characteristic. This ROD establishes an Area of Contamination (AOC) for VOC-contaminated soil, which encompasses Parcel B. Pursuant to EPA policy, because an AOC is equated to a RCRA land-based unit, consolidation and *in situ* treatment of hazardous waste within the AOC do not create a new point of hazardous waste generation for purposes of RCRA. Therefore, soil within the AOC may be consolidated or treated *in-situ* without triggering RCRA land disposal restrictions (LDRs) or minimum technology requirements.

## 4.4 Future Response Actions

At a future date, EPA will issue a separate ROD to address Operable Unit 2, contaminated

groundwater. In 2000 EPA will conduct additional groundwater investigation activities to more fully define the extent of the four groundwater contamination plumes identified during the RI. EPA will also conduct an investigation of the western lot of Parcel A to locate and characterize a suspected source of VOC groundwater contamination plume 4. A proposed plan identifying EPA's preferred remedial alternative for OU 2 and a ROD for OU 2 are projected to be issued by EPA in 2001.

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# 5.0 SUMMARY OF SITE CHARACTERISTICS

This section summarizes regional characteristics and site conditions, including discussions of the ecological setting, climate, surface water patterns, geology, and hydrogeology, as well as the nature and extent of chemicals of concern at the Northwest Pipe and Casing Superfund site.

## 5.1 ECOLOGICAL SETTING

### 5.1.1 FLORA AND FAUNA

The study area is situated within the Williamette Basin . The development that has taken place in the vicinity of the site has altered the natural vegetation of the site, making it less likely that many wildlife species would use the area. Parcel A lacks any significant ecological habitat due to its nearly complete cover with buildings and pavement. Existing habitat types within Parcel B include upland nonforested/disturbed, scrub/shrub, upland mixed deciduous, and aquatic flowing and nonflowing habitats. Due to extensive past disturbances at the site, the vegetative composition is relatively uniform and lacking diversity. Approximately 40 percent of Parcel B consists of pavement, angular to subangular gravel, or barren soil.

The majority of vegetated areas are dominated by three to four non-native species, including Himalayan blackberry, black cottonwood, Russian knapweed, reed canary grass and sphagnum moss. These species proliferate aggressively and are well known for establishing in areas of significant soil disturbance. The developed parts of the site, on Parcel A along SE Lawnfield Road, include numerous ornamental plants.

Terrestrial wildlife found within the site include a variety of mammals, including deer mice, raccoon, eastern cottontail and European rabbit. All of these species, except for the deer mice, have home ranges which are likely to extend beyond the site boundaries. The racer snake was the only reptile/amphibian observed at the site. Diverse populations of migratory and nonmigratory birds were observed within the site boundaries. Birds observed in highest abundance included American crow, American robin, European starling, killdeer, scrub jay, red-winged blackbird, California qual and song sparrow.

Two man-made drainage ditches are situated along the eastern and western boundaries of the site (**Figure 5-1**). Trash and various debris are present in many portions of these drainage ditches, and their substrates are characterized by dense vegetated bed with mixed sand, mud and gravel substrates. These ditches and associated bottom substrates do not provide significant habitat to aquatic organisms. Only one fish species, the mosquitofish, was observed in the ditches.

Dean Creek and Mt. Scott Creek downstream from the site provide wildlife habitat for resident and anadromous fish species. Mt. Scott Creek flows northward into Kellogg Creek which flows into the Willamette River. Mt. Scott and Kellogg Creeks provide spawning, nursery and adult habitat for anadromous steelhead trout and coho salmon, and resident cutthroat trout. Other significant

anadromous species which use the Willamette River system include white sturgeon, pacific lamprey, chinook salmon, and American shad.

Several anadromous fish species of concern are known to be present in the Willamette River and Mt. Scott Creek and may possibly occur in Dean Creek. The National Marine Fisheries Service (NMFS) has listed the Lower Columbia River steelhead (*Onchorynchus mykiss*) as threatened, the Lower Columbia River/Southwest Washington coho salmon (*Onchorynchus kisutch* ) as a candidate for listing, and the Lower Columbia River/Southwest Washington cutthroat trout ( *Onchorynchus clark clarki*) as proposed for listing as threatened. The U.S. Fish and Wildlife Service has listed the Columbia River bull trout as threatened.

EPA conducted an informal consultation with the National Marine Fisheries Service (NMFS) concerning the selected soil remedy. The NMFS concurred with EPA's determination of no adverse effects on threatened or endangered fish.

The Nelson's checker-mallow (*Sidalcea nelsoniana*) plant is the only species potentially present at the site, based on habitat type, that is listed as either threatened or endangered. However, a plant survey conducted at the site determined that the plant was not present.

### 5.1.2 CLIMATE

The Northwest Pipe and Casing Company site is located in the Willamette River valley, approximately midpoint between the Pacific Ocean and the Cascade Mountain range. The climate in the region is characterized by dry summers and wet winter seasons. Prevailing winds in the spring and summer are from the southeast and in the winter and fall are from the north-northwest. Throughout the year, average speed is 7 to 10 miles per hour. Monthly precipitation averages range from almost 6 inches in January, November and December to less than 1 inch in July and August. The average annual precipitation is approximately 37 inches per year.

Historical winter daytime temperatures are typically between 40 and 50 degrees Fahrenheit (EF), while nighttime temperatures range in the mid-to upper 30's. Summer daytime high temperatures typically range in the mid- to upper 70's, with nighttime summer lows in the 50's.

Precipitation was unusually high when the Remedial Investigation was conducted in 1997. The annual precipitation for 1997 was 44 inches, or 7 inches above the annualized average.

### 5.1.3 FLOOD PLAINS AND WETLANDS

The site is not in a floodplain, but is susceptible to ponding due to poor drainage. Groundwater is at or near the ground surface in the wet season. There are no designated wetlands on the site. Although several ponded areas form in depressions on Parcel B in the winter, none of these features strongly displayed positive evidence of hydrophytic vegetation, hydric soils and wetland hydrogeology.

## 5.2 GEOLOGIC CONDITIONS

The site is located within the Portland basin, a major sediment-filled depression found in the northern part of the Willamette River valley and adjoining the Columbia River valley. Geology of the area consists of coarse-grained Clackamas River fluvial deposits overlain by silt- and clay-rich flood deposits, such as those generated during the Missoula Flood of the Columbia River basin. The fluvial deposits in the vicinity of the site may have been deposited by the ancestral Clackamas River. These deposits are underlain by the Boring lavas, which are the younger basalts of the Columbia River Basalt Group. The uppermost regional unit is recent alluvium consisting of interbedded and variable silts, sands and gravels.

Five distinct subsurface geologic units have been identified at the site. The geologic conditions at the site are summarized on a geologic cross section of the area, presented as **Figure 5-2 and Figure 5-3** (**Figure 5-1** shows the cross section location).

**Fill Unit -** Imported silty gravels extending from ground surface to a depth of 1 to 1.5 feet.

**Upper Silt Unit** - Comprised of 90 percent silt and clay and 10 percent sand, topically moist. Extends to a depth of 4 to 6 feet bgs.

**Upper Gravel Unit** - Varies with depth from silty gravel in upper portion to well-graded gravels to cemented gravels in lower portion. Extends to a total depth of about 90 feet bgs.

**Lower Silt Unit** - Hard dark gray silt encountered at depths of about 90 feet bgs. Borings were advanced 2 feet into unit; no borings penetrated this unit. Comprised of silt, clay and sandy silt.

**Lower Gravel Unit** - not encountered during EPA's Remedial Investigation. Available information is derived from the drilling log for an existing well on Parcel A ("ODOT industrial well").

## 5.3 HYDROGEOLOGIC CONDITIONS

The hydrogeologic conditions beneath the site are depicted on cross-sections included as **Figure 5-4 and Figure 5-5.** Two aquifer systems are located beneath the site. The Upper Aquifer consists of poorly sorted fine-to-coarse gravels and sandy gravels in the upper gravel unit which underlie the upper silt/fill/debris units. Occasional sand/silt zones or lenses, generally 1 to 2 feet thick, are noted. The upper aquifer extends to depths of 87 to 103 feet bgs. All monitoring wells installed during the RI were completed in the upper aquifer. The upper aquifer was divided into shallow, intermediate and deep portions, based on the grouping of monitoring wells.

The Lower Aquifer is a gravel unit, located beneath the lower silt unit. The lower aquifer is artesian and consists of gravel and sandy gravel, as described by the well log for the ODOT industrial well which is screened in the lower aquifer beneath the lower silt unit. The ODOT industrial well is the only boring on the site to penetrate the entire thickness of the lower silt unit.

This well was reportedly used by Northwest Pipe and Casing Company for process water in pipe manufacturing. The ODOT well is not currently in use.

Groundwater flow direction in the upper aquifer is generally towards the north and northwest, with no significant seasonal changes observed (see **Figure 5-6**). Groundwater flow velocity in the upper aquifer at the site is 0.3 foot/day. The volume of groundwater flowing through the upper aquifer at the site is estimated to be 101,000 gallons/day.

Portions of groundwater from the shallow upper aquifer discharge to adjacent drainage channels DC1 and DC2. In the drier summer months, water is absent from DC1 and DC2, corresponding to periods when the upper aquifer water table drops below the bottom of the channels. It is unknown if the drainage channels have much direct influence on groundwater flow in the intermediate or deep parts of the upper aquifer. A groundwater dewatering system consisting of two tiled vertical drains is present on the western side of the ODOT building on Parcel A. The drains locally depress the water table by about 2 to 4 feet.

Groundwater at the NWPC site is not currently used for drinking water, but has the potential to be used in the future. The closest known downgradient withdrawal of groundwater for domestic purposes is approximately one and one-half miles northwest of the site.

## 5.4 SITE FEATURES

Former and current site features are shown in **Figure 2-2**.

Parcel A

The western lot of Parcel A is currently owned by ODOT and is used as an equipment yard and warehouse/office. The majority of the lot is paved with asphalt and contains landscaped areas near the ODOT building. A soil pile (designated pile 4), with an estimated volume of 2,100 cubic yards, is present south of the ODOT building. The source of the pile is unknown. A 115-foot-deep industrial well is located on the north side of the ODOT building. Three 10,000-gallon fiberglass underground storage tanks (USTs) are located south of the ODOT building. One of the tanks was abandoned in place in 1993. The tanks contained gasoline and diesel. A 1,000-gallon steel UST located at the northeast corner of the ODOT building and used to store fuel was removed by ODOT in 1992. Two vertical drains are present along the ODOT building, apparently used to lower the local groundwater table to protect the building foundation from upwelling. The drains are connected to discharge pipes leading to the drainage ditch at the western edge of the building.

The eastern lot of Parcel A is owned by Northwest Development Company and is occupied by three low-rise buildings housing commercial businesses. This lot is paved with asphalt and contains small landscaped areas.

Parcel B

Parcel B is vacant and contains remnants of former pipe-coating operations. The lot is generally flat and overgrown with low-lying vegetation and thick blackberry brambles. Three soil and debris piles are present on the northern portion of Parcel B. Pile 1 contains approximately 750 cubic yards of primarily asphalt. Pile 2 contains soil which reportedly originated from Parcel A during site grading and has an estimated volume of 1,850 cubic yards. Pile 3 consists of soil and debris of unknown origin and has an estimated volume of 6,000 cubic yards. A steel storage tank and two metal bins are located outside the site perimeter fence near the southwest corner of Parcel B. The tank has a capacity of approximately 12,000 gallons and is half full with hardened coal tar. The metal bins are approximately 1-3 cubic yards in size and partially full with household type refuse

There are several in-ground structures, including USTs, drains/sumps, and miscellaneous abandoned piping on Parcel B. Two USTs were confirmed during the RI and removed in December 1998. Four 4-foot-diameter drains are located on Parcel B. Areas around the former buildings contain numerous abandoned piping of various sizes. An in-ground structure approximately 40 feet long and 6 feet wide is located along the northern edge of Plant 3. The soil surface around the structure is covered with hardened coal tar and iron-oxide stained soil. The structure is believed to have contained pipe-coating material.

Three burial areas were reported by former company employees to exist on Parcel B.

## 5.5 SAMPLING OF SOIL, GROUNDWATER, SURFACE WATER AND SEDIMENTS

The Remedial Investigation (RI) included sampling of soils, groundwater, surface water and sediments. Soil samples were tested using field PCB and field high molecular weight PAH (HPAH) test methods; approximately 25 per cent of the soil samples were also tested using laboratory PCB and HPAH analytical methods. The RI sampling methodology included limited laboratory PCB and HPAH analyses of surface soil samples because considerable surface soil data of known and acceptable data quality had been gathered during previous site investigations. Test pit exploration was the principal method used for the soil investigation to assess the extent of lateral and vertical soil contamination. Test pits were located in the suspected contaminant source areas including the alleged burial areas; Plants 1, 2, 3 and 4; potential UST locations, soil piles and vertical drain structures. The remainder of Parcel B was sampled by advancing approximately 214 test pits on a hexagonal grid using 100-foot spacings. Soil sampling locations are shown on **Figure 5-7**. Test pits were excavated to the water table, which varied from about 4 to 10 feet below ground surface (bgs). Soil below the water table was not sampled, based on knowledge of historical operations and alleged waste disposal practices and the difficulty in obtaining representative samples in saturated conditions. RI field activities included a total of 262 soil test pits and eight soil borings.

Groundwater was sampled at 47 push-probe locations and at 14 existing and 11 new groundwater monitoring wells. The new groundwater monitoring wells generally were located in areas where groundwater contamination was suspected. The monitoring wells were installed at different depths in the upper aquifer. Monthly water level measurements were made and slug testing of selected monitoring wells was conducted during the RI. Soil cuttings and related investigation-derived

wastes (IDW) from the RI were placed in drums and are currently stored on the site.

A total of 57 surface water and sediment samples were collected at 18 locations in natural and man-made drainages upstream, adjacent and downstream of the site. Surface water was sampled in two rounds, one during high runoff conditions and one during low runoff conditions. Sediment samples were collected only during the high runoff round. Sediment samples were co-located with surface water sampling locations to provide data on the accumulation of constituents of potential concern in creek and drainage channel beds.

A wetland identification survey of the site was conducted during the RI to determine if areas within the site were classified as wetlands.

## 5.6 NATURE AND EXTENT OF CHEMICALS

The nature and extent of contamination is summarized in the following subsections. Additional information is included in the Remedial Investigation Report.

### 5.6.1 Identified Chemicals

#### 5.6.1.1 Soil Chemicals

*Parcel A*

No major sources of contamination were found in soils on Parcel A; however, soil sampling on Parcel A was very limited due to the extensive coverage by buildings and paved areas. Concentrations of polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) in Parcel A soils were generally much lower than the levels observed on Parcel B.

*Parcel B - Summary*

Numerous areas of surface and subsurface soil on Parcel B are contaminated with PAHs, PCBs and to a lesser extent with chlorinated volatile organic chemicals VOCs. The upper 3 feet of soil across Parcel B has been moderately impacted by HPAHs and PCBs. Average total HPAHs and total PCBs concentrations in subsurface samples from gridded test pits exceeded 25 mg/kg and 1.5 mg/kg respectively.

As an example of the levels of individual HPAH compounds detected in soil, benzo(a)pyrene was detected in 18 of 21 surface soil samples at a mean concentration of 54.4 mg/kg and maximum concentration of 410 mg/kg. In subsurface soil, benzo(a)pyrene was detected in 80 out of 144 subsurface soil samples, at a mean concentration of 2.6 mg/kg and maximum concentration of 48 mg/kg. **Figure 5-8** shows the concentrations of benzo(a)pyrene in soil at all depths.

*Parcel B - Surface Soil*

Total HPAH and total PCBs concentrations in soil samples from the top 1 foot of soil on Parcel B are shown on **Figures 5-9** and **5-10** respectively. Total HPAH concentrations in test pits frequently exceeded 10,000 mg/kg; total PCBs concentrations in test pits varied considerably, from less than 1 mg/kg to between 10 and 100 mg/kg.

The highest concentrations of HPAHs and PCBs in surface soil are located in the northern portion of Plant 3, where HPAHs concentrations exceeded 390,000 mg/kg and PCBs were detected up to 870 mg/kg.

*Parcel B - Subsurface Soil*

Soil underlying and surrounding the former plant buildings on Parcel B is contaminated with HPAHs and PCBs. Soil in these areas was frequently stained and contained localized accumulations of black oily free product and hardened coal tar. Contaminants in these areas most likely originated from poor housekeeping practices, spills, discharges, and product leaks from buried process pipes during historic operation of the pipe coating plants.

Elevated HPAH concentrations (>300 mg/kg) were found in subsurface soil down to the water table depth (>6 feet bgs) in test pits not containing buried debris. This distribution of contaminants suggests that some limited migration of PAH- and PCB-bearing light nonaqueous phase fluids (LNAPLs) has occurred at the top of the shallow aquifer. However, no accumulation of floating product was observed.

Total HPAH and total PCBs concentrations in subsurface soil samples from between 3 and 6 feet bgs on Parcel B are shown on **Figures 5-11** and **5-12** respectively. The highest levels of HPAHs and PCBs in subsurface soil occur at Plant 3 and Plant 4, although localized, very high concentrations of HPAHs (>1,000 mg/kg) also occur along the west side of plant 2. The highest PCB levels (up to 400 mg/kg) were associated with black oily product at Plant 4.

VOC levels in subsurface soil were relatively low except at the southeast corner of Plant 3 and at the extreme southeast corner of Parcel B. At Plant 3, PCE was detected in 5 of 6 samples at concentrations ranging from 0.004 mg/kg to 370 mg/kg. The maximum PCE concentration was in a test pit at a depth of 0.5 feet; the soil was stained black and had a strong chemical odor. PCE at this location was present at depths to the water table, suggesting that soil in the vicinity of this test pit is a potential source to groundwater.

*Parcel B - Burial Areas*

Three main contaminated debris burial areas were confirmed by the RI. Buried debris consists mostly of coal tar fragments, milled wood, plastic, metal and concrete. Several buried drums of solidified coal tar were encountered in test pits. Some of the buried debris at the northwest part of Parcel B was burnt. The principal contaminants in the three burial areas are HPAHs and PCBs; for example, soil HPAH and PCB concentrations in Burial Area 1 are shown in **Figures 5-13 and 14**

respectively.

*Soil Piles 2, 3 and 4*

Total HPAHs were detected in 19 of 23 samples from the soil piles. The mean concentration of Total HPAHs was 1.4 mg/kg and the maximum concentration of HPAHs was 10.3 mg/kg. Total PCBs were detected in 21 of 23 samples from the soil piles. The mean concentration of total PCBs was 0.5 mg/kg and the maximum concentration of PCBs was 5.1 mg/kg. Arochlor 1254 was by far the predominant PCB detected. PCE at 45 Fg/kg and TCE at 10 Fg/kg were detected in 1 of 23 samples from the soil piles.

Soil pile 1 was not sampled because it is primarily asphalt.

Based on the relatively low concentrations of contaminants compared to underlying subsurface soil, the soil piles do not appear to be a significant contamination source.

**5.6.1.2 Groundwater Chemicals**

Chlorinated solvents, principally PCE, are the primary chemicals detected in groundwater at the site. Trichloroethene (TCE), cis-1,2 dichloroethene (DCE), and vinyl chloride are also present in groundwater; they are believed to represent breakdown products of the PCE.

- PCE was detected in 44 out of 78 groundwater samples, ranging from 0.2 to 11,000 Fg/L.
- TCE was detected in 53 out of 78 groundwater samples, ranging from 0.2 to 1,900 Fg/L.
- Cis-1,2-DCE was detected in 59 out of 78 samples, ranging from 0.4 to 3,000 Fg/L.

Dense nonaqueous phase liquids (DNAPLs) were not observed in any of the monitoring wells at the site.

Four groundwater plumes of PCE and its breakdown products exist in the shallow upper aquifer. The areal distribution of PCE in groundwater is shown in **Figure 5-15**. Three plumes originate in the southeast corner, the southwest corner and near Plant 3 on Parcel B. The 1,500-foot plume arising at Plant 3 has the highest levels of PCE detected (11,000 Fg/L) in the groundwater at the site. A fourth plume of PCE-containing groundwater also exists on the western (ODOT) lot of Parcel A. The source of this plume is unknown, as chlorinated VOCs were not detected in a soil boring located in the suspected source area southeast of the ODOT building. The concentrations of chlorinated solvents decrease with depth in the upper aquifer, although groundwater concentrations exceed drinking water standards at depths up to 50 feet bgs. The shallow portion (0 to 20 feet bgs) of the upper aquifer is most impacted by the chlorinated solvents.

Elevated concentrations of PCE above drinking water standards were also detected in an artesian,

industrial well screened in the lower aquifer on the ODOT property. The PCE in this well is believed to originate from an up gradient source, as the lower aquifer does not appear to be hydraulically connected to the upper aquifer in the immediate vicinity of the Northwest Pipe and Casing Company site. Furthermore, VOCs were not detected in the deepest portion of the upper aquifer, indicating lower aquifer VOC contamination is likely from another source. EPA plans to conduct further groundwater investigation at the site to more conclusively determine if the ODOT industrial well contamination could be from the Northwest Pipe and Casing Company site. DEQ has identified other sites in the vicinity with groundwater contamination, which have not been ruled out as a possible source of the PCE contamination in the lower aquifer at ODOT. DEQ is working with those site owners on groundwater investigations.

PAHs such as acenapthalene, fluoranthene, and naphthalene were detected only in shallow groundwater at low levels in limited locations. These levels are markedly lower than levels measured during previous field investigation in 1990. Inorganic constituents such as metals were detected in groundwater on site at relatively low concentrations, although the levels were higher than in up gradient samples; however, no distinct plumes were recognized.

Note: Groundwater response actions will be addressed by a separate ROD for the groundwater OU, projected to be issued in 2001.

#### 5.6.1.3 Surface Water Chemicals

Concentrations of VOCs, the primary contaminants, in surface water are shown in **Figure 5-16.** Surface water in drainage ditches DC1 and DC2 adjacent to the west and east site boundaries is mildly impacted by chlorinated solvents:

- PCE ranged from 0.7 to 0.9 Fg/L in DC1 and was measured at 2 Fg/L in DC2.
- Cis-1,2 DCE ranged from 3 to 13 Fg/L in DC1 and at 9 Fg/L in DC2.
- TCE was detected at 1 Fg/L in DC1 and at 2 Fg/L in DC2.

These observations support the existence of a hydraulic connection between site groundwater in the shallow upper aquifer and the adjacent surface water drainage channels.

TCE and cis-1,2 DCE were also detected in Dean Creek downgradient from the site, at levels of 1.0 Fg/L and 3.0 Fg/L respectively.

#### 5.6.1.4 Sediment Chemicals

PAHs and PCBs were the primary chemicals detected in sediment and substrate soils of the drainage channels adjacent to the site. Concentrations of PAHs and PCBs in sediments are shown in **Figures 5-17 and 5-18.** HPAHs up to 30 mg/kg and PCBs up to 5.8 mg/kg were detected in DC1

and up to 2.7 mg/kg and 0.24 mg/kg respectively in DC2. These same constituents were observed at relatively higher concentrations at up gradient locations during previous investigations and from locations situated outside the hydrologic influence of the site (Drainage Channel 3) during this RI. This suggests there are likely additional sources of the PCBs and PAHs found in some of the sediments.

Creek sediments downgradient from the site demonstrate a decreasing trend for HPAHs and PCBs (Arochlor 1254). Sediment in Dean Creek downgradient from the site contained HPAHs at 14.6 mg/kg and PCBs (Arochlor 1254) at 0.1 mg/kg.

### 5.6.2 Chemicals of Potential Concern (COPCs)

Of the chemicals identified in soil, groundwater, surface water and sediments at the site (Section 5.6.1), those which could pose a threat to human health or the environment are identified as COPCs for further evaluation in the baseline risk assessment (Section 6.0). Following the baseline risk assessment, soil contaminants of concern (COCs) are selected from the list of COPCs, based on potential human exposures at the site, to represent the specific chemicals of concern for which remedial action objectives and remediation goals are established. This process is further explained in Section 7.

COPCs were selected by a screening process that compared the maximum detected chemical concentrations to risk-based concentrations on a medium-by-medium basis. The risk-based concentrations used were the preliminary remediation goals (PRGs) calculated by EPA Region IX, and were based on standard default exposure assumptions for residential exposure. The Region IX PRGs are protective of human health at the $1 \times 10^{-6}$ excess cancer risk level and the noncancer hazard quotient of one.

Chemicals detected at the site were screened out if; they were detected less than 5 percent of samples, they were present below background concentrations, if they were considered an essential nutrient for which there is no risk-based concentration available, or if there is no risk-based concentration available. This screening process is described in more detail in the human health risk assessment (Section 6.0).

The list of COPCs selected for the Northwest Pipe and Casing Company site is presented in **Table 5-1.** The principal COPCs in soil and sediments are PAHs, PCBs, and to a lesser degree, inorganics. The principal COPCs in groundwater and surface water are VOCs and inorganics.

### 5.6.3 Contaminant Fate and Transport

This subsection discusses the physical-chemical properties of the COPCs and contaminant transport pathways likely present at the site.

### 5.6.3.1 Potential Sources of Contaminants

A number of historical and continuing sources of contamination to soil and groundwater at the Northwest Pipe & Casing site are possible, including:

- Historical, direct release, spills, and disposal/burial of used or waste coal tar and solvents.
- Historical, direct release of process wastewater from the facility.
- Historical disposal of debris.
- Historical and continuing erosion of contaminated soil by surface water.
- Historical and continuing surface water runoff transport of contaminated storm water from the facility.
- Historical and continuing transport by surface water infiltration and leaching of contaminated soil to groundwater.
- Historical and continuing transport by groundwater leaching of coal tar buried within the saturated zone.

### 5.6.3.2 Uses and Properties of Contaminants

The PAHs detected at the Northwest Pipe and Casing Company site are associated with coal tar used as a protective pipe coating. Coal tar is a complex mixture of hundreds of individual compounds, mainly PAHs. The major PAH components of coal tar are naphthalene, phenanthrene, anthracene, and fluoranthene. Coal tar was used extensively for coating pipe on the site.

PCBs are a class of synthetic chemicals widely used in industry due to their physical and chemical stability. PCBs may have been used in electrical equipment used at the site, since they have excellent electrical insulating properties. They have low water solubility, high oil solubility and strongly absorb to organic matter. PCBs may have been released to soil at the site during malfunctions or maintenance of electrical equipment, or by being present as a contaminant in oil applied to dirt roadways at the site for dust suppression.

Chlorinated solvents such as PCE and TCE have been extensively used in industry as degreasing and cleaning solvents. Records supplied by Southern Pacific Railroad show large quantities of PCE were delivered to the Northwest Pipe and Casing Company site during historical pipe coating operations. TCE and cis-1,2-DCE likely were not used at the site since concentrations are orders of magnitude lower than found for PCE. They may have been present as minor constituents in the technical grade PCE commonly used, or may result from the anaerobic biodegradation of PCE. PCE

and TCE are volatile liquids at room temperature with densities greater than water. If volumes of PCE and/or TCE released to the environment are greater than the adsorptive capacity of the soil, they will migrate downward under the influence of gravity.

### 5.6.3.3 Fate and Transport of Primary Contaminants

Contaminant adsorption to soil, partitioning between soil and water, and dissolution to water are closely related processes which can influence contaminant migration. Compounds adsorbed to soil can undergo leaching and dissolution by infiltrating rain, surface water, or in the saturated zone, by groundwater moving through a contaminated area.

As coal tar weathers in the soil environment, the more soluble LPAHs, such as naphthalene, phenanthrene and anthracene, and phenolic components will migrate from the mixture, making it more tar-like and less mobile. HPAHs and PCBs are strongly adsorbed to soil, and therefore will not be released readily or in large concentrations when in contact with water. Although some dissolution will occur over time, migration of dissolved HPAHs and PCBs is unlikely due to their large soil/water partition ratios. The HPAHs and PCBs will be preferentially adsorbed by soil, retarding their migration in the environment.

Chlorinated solvents have lower soil/water partition ratios, indicating these compounds are less strongly sorbed to soil and, therefore, preferentially leach or dissolve into the groundwater. Similarly, the dissolution of chlorinated solvents leached into groundwater likely will not be significantly retarded as they move through soil, and so may continue to migrate.

Volatilization of PCE, TCE, DCE and vinyl chloride from soil, particularly for surface or near-surface contamination, is likely to be significant since these chlorinated solvents have relatively high vapor pressure. Henry's law partition coefficients for these volatile compounds are relatively high, indicating transfer of dissolved contaminants from water to interstitial soil vapor is likely. Conversely, HPAHs and PCBs will exhibit little or no transfer from water to air and direct evaporation from soil to air is also unlikely due to their low vapor pressures.

HPAHs have been found to undergo little or no degradation in soil under normal environmental conditions. PCBs also are fairly recalcitrant to natural biodegradation due to their low solubilities and high degree of chlorination. PCE can undergo stepwise reductive dechlorination under anaerobic conditions. Conditions at the Northwest Pipe and Casing Company are generally not conducive for reductive dechlorination of PCE in groundwater, due to the low levels of organic matter present in the upper gravel unit and the relatively high redox potentials; however, the distribution of PCE and its daughter products suggests that reductive dechlorination has occurred at some locations on the site.

### 5.6.3.4 Site Conceptual Model

Potential migration pathways for contaminants are summarized in the conceptual site model

depicted in **Figure 5-19**. Based on site characteristics and the discussion above, migration of the main contaminants at the site is expected to be significant only for chlorinated solvents and perhaps, LPAHs. The HPAHs and PCBs are expected to be relatively immobile due to their strong binding affinity to soil, low water solubility, and low vapor pressure.

The main transport pathway for the PCE and its degradation products is most likely leaching to groundwater from soil and migration downgradient with groundwater flow. This is confirmed by the occurrence of PCE and its degradation products in groundwater on a significant portion of the site. Since adsorption and retardation are relatively low, eventual off-site migration of VOC-contaminated groundwater is possible. A secondary VOC transport pathway is evaporation to the atmosphere but this is probably significant only for areas of shallow soil contamination. Discharge of VOCs in shallow groundwater to the adjacent drainage channels is the primary pathway for VOCs migrating to surface water.

The primary transport pathway for LPAHs is also likely to be leaching. Compared with PCE and its breakdown products, LPAHs migration will be significantly retarded due to their high adsorption coefficients. This is demonstrated by the very limited occurrence of PAHs in groundwater at the site.

Surface soil erosion by water or wind is not expected to be a primary transport process at the site. Since the site topography is relatively flat, surface water runoff does not have sufficient velocity to suspend and transport soil for any distance. Likewise, surface soil is wet much of the year and little or no wind-blown dust is generated. Even during dry periods, little dust is observed since much of the site is covered with grass and other vegetation.

### 5.6.4 RCRA Hazardous Wastes

This subsection discusses the extent, if any, to which soil or debris at the Northwest Pipe and Casing Company site may contain hazardous wastes under RCRA.

*RCRA Subtitle C*

Subtitle C of RCRA establishes a system for the management of hazardous wastes. EPA has adopted extensive requirements for hazardous waste handlers under regulations in 40 CFR Parts 260 through 265 and 268. The state of Oregon has adopted as state regulations most of the RCRA Subtitle C regulations. These federal and state regulations may be ARARs for a Superfund remedial action if: 1) the waste is a RCRA hazardous waste, and 2) the activity at the site constitutes treatment, storage or disposal, as defined by the RCRA regulations.

*Waste Identification*

A waste is a RCRA hazardous waste if it is a listed or characteristic waste. To determine whether a waste is a listed waste it is often necessary to know its source. EPA does not have verifiable

information on the materials or wastes which may have been generated during the operation of the Northwest Pipe and Casing Company and the Hall Process Company at the site. Former employees deposed in 1996-97 during litigation gave only generalized descriptions of the materials used and disposed on-site, such as solvents, paints, primer, etc. The exact nature or source of the waste materials involved was not able to be confirmed. Therefore, EPA is able to assert affirmatively that soil contamination of the Northwest Pipe and Casing Company site is not from RCRA-listed hazardous wastes.

A waste is a characteristic hazardous waste if it exhibits a characteristic under 40 CFR Part 261. Either testing the waste or best professional judgement may be used to determine if the waste exhibits a characteristic. Based upon the nature of contaminants detected in soil at the Northwest Pipe and Casing Company site, the only characteristic under 40 CFR Part 261 most likely to be applicable to site soil is the Toxicity Characteristic Leaching Procedure (TCLP). The TCLP tests an extract of the waste for concentrations of 40 selected contaminants. If the waste extract exceeds the maximum concentration for the contaminant then the waste exhibits the characteristic of toxicity and is a RCRA hazardous waste.

Based upon the results of the Northwest Pipe and Casing Company RI, EPA believes it is possible that some soil at the site, if tested for TCLP, would exceed the TCLP maximum concentration of 0.7 mg/L for PCE. For example, subsurface soil sampled in the vicinity of Plant 3 had concentrations as high as 370 mg/kg PCE. The relatively low soil/water partition ratio of PCE indicates it less strongly sorbed to soil; therefore, PCE would be expected to preferentially leach from soil during the TCLP test.

EPA did not conduct TCLP tests of soil during the Northwest Pipe and Casing Company RI, but, on the basis of soil PCE concentrations, estimates that approximately 120 cubic yards of soil may fail the TCLP for PCE. For the purposes of developing and evaluating soil remedial alternatives in the feasibility study and this ROD, EPA will presume that TCLP soil and hence RCRA characteristic waste is present in these limited areas of the site. EPA will conduct the TCLP test on soil to verify this presumption prior to implementing the selected remedy.

As discussed in Section 4.3 and Section 10.2, this ROD will designate an Area of Contamination (AOC) for TCLP soil, to allow consolidation and *in situ* treatment of the TCLP soil within the AOC while not creating a new point of hazardous waste generation for purposes of RCRA.

The RCRA requirements which may be ARARs for TCLP characteristic soil are identified and discussed in subsequent sections of this ROD.

**Table 5-1**
**Human Health Contaminants of Potential Concern (COPCs)**

| COPC | Surface Soil | Combined Surface and Subsurface Soil | Groundwater | Surface Water | Sediment |
|---|---|---|---|---|---|
| Inorganics | | | | | |
| Antimony | **U** | **U** | | **U** | **U** |
| Arsenic | **U** | **U** | **U** | | **U** |
| Barium | **U** | **U** | | | |
| Beryllium | | **U** | | | |
| Cadmium | | **U** | **U** | | |
| Chromium | **U** | **U** | | | |
| Copper | | **U** | | | |
| Iron | **U** | **U** | **U** | **U** | |
| Lead | | | **U** | | |
| Manganese | **U** | **U** | **U** | **U** | **U** |
| Mercury | | | **U** | | |
| Nickel | | **U** | | | |
| Thallium | | **U** | **U** | **U** | |
| Vanadium | **U** | **U** | | | **U** |
| VOCs | | | | | |
| Acetone | | | **U** | | |
| Benzene | | | **U** | | |
| Carbon Tetrachloride | | | **U** | | |
| Chlorobenzene | | | | | |
| Chloroform | | | **U** | **U** | |
| 1,1-Dichloroethene | | | **U** | | |
| cis-1,2-Dichloroethene | | | **U** | **U** | |

**Table 5-1 (cont.)**
**Human Health Contaminants of Potential Concern (COPCs)**

| COPC | Surface Soil | Combined Surface and Subsurface Soil | Groundwater | Surface Water | Sediment |
|---|---|---|---|---|---|
| trans-1,2-Dichloroethene | | | | | |
| Methylene Chloride | | U | | | |
| Tetrachloroethene | | U | U | U | |
| 1,1,2-Trichloroethane | | | U | | |
| Trichloroethene | | | U | | |
| Vinyl chloride | | | U | U | |
| SVOCs | | | | | |
| bis(2-ethylhexyl)phthalate | | | U | | |
| Carbazole | | U | | | |
| Dibenzofuran | U | U | U | | |
| 2-Methylnaphthalene | | U | U | | |
| PAHs | | | | | |
| Acenaphthene | U | U | U | | |
| Acenaphthylene | | | U | | |
| Anthracene | U | U | | | |
| Benzo(a)anthracene | U | U | | | U |
| Benzo(a)pyrene | U | U | | | U |
| Benzo(b)fluoranthene | U | U | | | U |
| Benzo(g,h,i)perylene | U | U | | | U |
| Benzo(k)fluoranthene | U | U | | | |
| Chrysene | U | U | | | |
| Dibenz(a,h)anthracene | U | U | | | |
| Fluoranthene | U | U | | | |
| Fluorene | U | U | U | | |

**Table 5-1 (cont.)**
**Human Health Contaminants of Potential Concern (COPCs)**

| COPC | Surface Soil | Combined Surface and Subsurface Soil | Groundwater | Surface Water | Sediment |
|---|---|---|---|---|---|
| Indeno(1,2,3-cd)pyrene | **U** | **U** | | | **U** |
| Naphthalene | | | | | |
| Phenanthrene | **U** | **U** | **U** | | **U** |
| Pyrene | **U** | **U** | **U** | | |
| Pesticides | | | | | |
| 4,4'-DDE | **U** | **U** | | | |
| alpha Chlordane | | | | | |
| Heptachlor | | **U** | | | |
| PCBs | | | | | |
| Aroclor 1248 | | | | | **U** |
| Aroclor 1254 | **U** | **U** | | | **U** |
| Aroclor 1260 | | | | | **U** |
| Total PCBs | **U** | **U** | | | **U** |
| Dioxins/Furans | | | | | |
| 2,3,7,8-TCDD (Equivalents) | | **U** | | | |

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# 6.0 SUMMARY OF SITE RISKS

## 6.1 INTRODUCTION

A baseline risk assessment was conducted to evaluate the current and future human health and ecological risks associated with chemicals in soil, groundwater, surface water and sediments at and in the vicinity of the Northwest Pipe and Casing Company site. The assessment serves as a baseline to indicate risks that could exist if no action were taken, and takes into consideration potential risks, if existing residential use patterns shift in the future, such as contaminated groundwater used as drinking water in homes. The results of the risk assessment are used in evaluating whether remedial action is needed.

The risk assessment followed the basic guidelines defined by the EPA and current scientific data. A risk assessment evaluates the likelihood of adverse effects occurring in human or ecological populations potentially exposed to chemicals released in the environment. Risk assessments are not intended to predict actual risk of an individual. Instead, they provide upper-bound and central tendency estimates of risk with an adequate margin of safety, according to EPA guidelines, for the protection of virtually all receptors that may potentially come into contact with chemicals at the site.

## 6.2 CURRENT AND POTENTIAL FUTURE LAND USE

The NWPC site is currently zoned for light industrial use. Parcel B has been vacant since 1986. Parcel A is occupied by an ODOT warehouse/office and equipment yard, and the three-building Clackamas Commerce Park.

Property adjacent and in proximity to the east and south of the site is used for a variety of industrial purposes, such as metal fabrication and equipment manufacturing. A large radio transmission tower complex operated by KEX radio occupies a large open field north of the site . The National Guard Camp Withycombe facility is located southeast of the site. The closest residence to the site is located approximately 500 feet to the southwest. A small residential area known as Hollywood Garden is located approximately one-half mile southeast from the site, just to the south of Camp Withycombe.

The reasonably anticipated future land use at the site is expected to remain light industrial and/or commercial, based on zoning maps developed by the Clackamas County. A highway project designated the Sunrise Corridor is being evaluated by the ODOT and if constructed could affect future uses of portions of the site. As currently planned by ODOT, the Sunrise Corridor project would include a multi-lane interchange between Interstate 405 and Highway 224, which would go across the Northwest Pipe and Casing Company site along a northwest-to-southeast line. The interchange likely would be raised above the current grade of the site. ODOT has not secured funding for the project, and projects that actual construction could be at least 10 years away.

Groundwater at and immediately downgradient from the site is not currently used for drinking water. Businesses and residences in the site vicinity are generally connected to Clackamas County Water District. However, the groundwater is considered to be a potential source of drinking water and therefore is classified as Class II groundwater under EPA's federal groundwater classification system. There are no known immediate plans for use of the groundwater.

## 6.3 HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment characterized risks to humans, both current and future, from exposure to chemical contaminants detected at the site. A conceptual Site Exposure Model for the site is presented in **Figure 6-1**. Exposures to transient trespassers, construction workers, maintenance workers, and off-site residents from contact with soil and groundwater contaminants were evaluated. Off-site residential exposure to groundwater was evaluated for both adults and children assuming they would use impacted groundwater as their tap water source in their homes at some point in the future.

The only current receptor evaluated was the transient trespasser. Transient residential populations or camps have been observed in the vicinity of the site. Transient trespass onto Parcel B is from cuts made in the chain link perimeter fence. Risks to the transient trespasser from incidental ingestion and direct dermal contact with soil, ingestion and inhalation of volatiles in surface water, and incidental ingestion and dermal contact with sediment were evaluated. No other current populations are likely to be exposed to site contaminants on a regular basis.

Note: The human health risks posed by the site to security patrol personnel were not evaluated in the baseline risk assessment because the patrols are performed by vehicle, vs. on-foot, and security personnel are required to comply with personal protection and safety requirements when conducting the patrols.

Since Parcel B is likely to be redeveloped for light industrial use, two future on-site worker populations were evaluated. Risks to a future on-site construction worker from exposure to soil by incidental ingestion, inhalation of particulate and volatiles and direct dermal contact were evaluated. An exposure period of 250 days over one year was used for the construction worker.

Risks to a future on-site maintenance worker from exposure to soil by incidental ingestion, inhalation of particulate and volatiles, and direct dermal contact, and ingestion and dermal contact with groundwater were evaluated.

Lastly, risks to the future off-site resident who may be exposed to groundwater contaminants through domestic use of the upper aquifer was evaluated. This scenario assumed that groundwater contaminants at the site will migrate to potential local domestic wells in the same concentrations as they are found on-site. Risks from dermal contact, ingestion and inhalation of volatiles from groundwater were considered.

The primary components of the risk assessment include data evaluation, exposure assessment, toxicity assessment, and risk characterization, which are discussed in the following subsections.

### 6.3.1 Data Evaluation

The initial step in the risk assessment reviewed the available sampling results for each affected environmental medium (e.g., soil, groundwater) to identify a list of chemicals, referred to as the chemicals of potential concern (COPCs), to be carried through the remainder of the risk assessment. COPCs were selected by a screening process that compared the maximum detected chemical concentrations to risk-based concentrations on a medium-by-medium basis. The risk-based concentrations used were the preliminary remediation goals (PRGs) calculated by EPA Region IX, and were based on standard default exposure assumptions for residential exposure. The Region IX PRGs are protective of human health at the $1 \times 10^{-6}$ excess cancer risk level and the noncancer hazard quotient of one. As explained earlier in section 5.5.2, some chemicals were eliminated by this screening process from evaluation in the risk assessment for reasons including low frequency of detection, present below background concentrations, or there was no risk-based level available for comparison.

Lists of the COPCs identified for surface soil, combined surface and subsurface soil, groundwater, surface water and sediment at the Northwest Pipe and Casing Company site are presented in **Tables 6-1 through 6-5**, along with the exposure point concentrations (Section 6.x.x)

### 6.3.2 Exposure Assessment

An exposure assessment typically evaluates sources, pathways, receptors, exposure duration and frequency, and routes of exposure to assess total human exposure to the COPCs at the site. This assessment identified the populations potentially exposed to chemicals at the site, the means by which exposure occurs, and the amount of intake from each exposure media.

The result of this process is a calculated daily intake per body weight for each medium of concern. The daily intake rate per body weight (intake or administered dose) combines exposure parameters for the receptors of concern (e.g., contact rates, exposure frequency and duration) with chemical-specific toxicity criteria and exposure point concentrations (EPCs) for the media of concern, to arrive at an estimate of health risk.

To calculate human intake of chemicals, EPCs must be estimated. EPCs are those concentrations of each chemical to which an individual may potentially be exposed for each medium at the site. EPCs were developed from the analytical data obtained during the remedial investigation and from previous investigations at the site. EPCs were calculated for both average or central tendency exposures (CT) and reasonable maximum exposures (RME) at the site.

The RME is an estimate of the highest exposure that is reasonably expected to occur at the site and may overestimate the actual risk for the majority of the population. The RME concentration was calculated as the lesser of the maximum detected concentration or the 95 percent confidence limit on the arithmetic mean, using half the sample detection limit for non-detected chemicals.

The CT estimate is defined as the average of typical exposures for that population. Calculations of a more "typical" exposure are designed to approximate more average exposures at the site. Each average exposure point concentration was calculated as an arithmetic average of the chemical results for a particular medium, using half the sample detection limit for non-detected chemicals. The average exposure scenario was evaluated to allow comparison with the RME scenario. **Tables 6-1 through 6-5** present the COPCs and their EPCs for surface soil, combined surface and subsurface soil, groundwater, surface water and surface sediment, respectively.

The exposure parameters used in the risk assessment to calculate the intake of site chemicals in terms of a daily dose per body weight are presented in **Tables 6-6 through 6-9.**

For the risk assessment, the populations of concern for exposures to site contaminants include hypothetical off-site residents (both adult and child) using the impacted groundwater as a tap water source in the future, future on-site construction workers excavating soil, and future on-site maintenance workers conducting general grounds-maintenance activities. Currently, off-site residents are not using the impacted groundwater as a water supply source in their households. In summary, the following pathways and routes of exposure were quantitatively evaluated in the risk assessment:

- Exposures to an adult transient trespasser through ingestion and dermal contact with soil, surface water and surface water sediment

- Exposures to an on-site construction worker through ingestion, dermal contact and inhalation (of particulates and volatiles) of surface and subsurface soil

- Exposures to an on-site maintenance worker through ingestion, dermal contact and inhalation (of particulates and volatiles) of surface and subsurface soil and groundwater

- Exposures to both off-site adult and child residents through indoor use of impacted groundwater by ingestion, dermal contact and inhalation (of volatiles)

### 6.3.3 Toxicity Assessment

The toxicity assessment identified the carcinogenic and noncarcinogenic human health effects associated with the COPCs and provided toxicity values that were used to calculate the dose-response relationship. The toxicity values describe the quantitative relationship between the level

of exposure (dose) to a chemical and the increased likelihood of adverse impacts (response). The intake factors calculated in the exposure assessment section were combined with toxicity values and chemical concentrations to estimate a cancer risk or a noncancer hazard.

Key dose-response criteria are EPA cancer slope factors (CSFs) for assessing cancer risks and EPA-verified reference dose (RfD) values for evaluating noncancer effects. Toxicity vales are derived from either epidemiological or animal studies, to which uncertainty factors are applied. These uncertainty factors account for variability among individuals, as well as for the use of animal data to predict effects on humans. Sources of these toxicity values are the EPA online database Integrated Risk Information System (IRIS) and EPA's Health Effects Assessment Summary Tables (HEAST).

The CSF is multiplied by the estimated daily intake rate of a potential carcinogen to provide an upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. CSFs are expressed in units of $mg/kg\text{-}day^{-1}$. The upper-bound estimate reflects the conservative estimate of risks calculated from the CSF. This approach makes underestimation of the cancer risk unlikely. This chemical-induced risk calculated based on the CSF is in addition to the risk of developing cancer due to other causes over a lifetime. Consequently, the risk estimates in this risk assessment are referred to as incremental or excess lifetime cancer risks. Cancer toxicity values for COPCs for ingestion/dermal and inhalation exposures are presented in **Tables 6-10 and 6-11**, respectively.

The chronic RfD, expressed in units of mg/kg-day, is an estimated daily chemical intake rate for the human population, including sensitive subgroups, that appears to be without appreciable risk of noncarcinogenic effects if ingested over a lifetime. Estimated intakes of COPCs are compared with their RfDs to assess the noncarcinogenic hazards. Noncancer toxicity values for COPCs for ingestion/dermal and inhalation exposures are presented in **Tables 6-12 and 6-13**, respectively.

### 6.3.4 Risk Characterization

The risk characterization process was performed to estimate the likelihood, incidence and nature of potential effects to human health that may occur as a result of exposure to the COCs at the site. The quantitative and qualitative results of the data evaluation, exposure, and toxicity assessment sections were combined to calculate risks for cancer and noncancer health effects. Because of fundamental differences in the mechanisms through which carcinogens and noncarcinogens act, risks were characterized separately for cancer and noncancer effects.

#### 6.3.4.1 Carcinogenic Risks

The potential health risks associated with carcinogens were estimated by calculating the increased probability of an individual developing cancer during their lifetime as a result of exposure to a particular chemical at the site. The chemical-specific exposure estimates (i.e., average lifetime dose) were multiplied by the chemical- and route-specific cancer slope factor, averaged over the

expected duration of exposure, to arrive at a unitless measure of probability, expressed numerically (e.g., 1 x $10^{-4}$ or 1E-4) of an individual developing cancer as a result of chemical exposures at the site.

A cancer risk estimate is a probability that is expressed as a fraction less than 1. For example, a cancer risk of 1 x $10^{-4}$ (1E-4) refers to an upper-bound increased chance of one in ten thousand of developing cancer as a result of site-related exposure to a carcinogen over the expected exposure duration. The National Oil and Hazardous Substances Pollution Contingency Plan recommends a target risk goal range for excess cancer risk of 1E-4 to 1E-6.

### 6.3.4.2 Noncarcinogenic Hazards

The potential for noncarcinogenic effects due to exposure to a particular chemical is expressed as the hazard quotient (HQ). An HQ was calculated by dividing the estimated intake or dose of a chemical by the chemical-specific toxicity value or noncancer RfD. Implicit in the HQ is the assumption of a threshold level of exposure below which no adverse effects will occur. If the HQ exceeds 1, site-specific exposure exceeds the RfD and the potential for noncancer adverse effects may exist.

### 6.3.4.3 Results

**Tables 6-14 and 6-15**, as well as the sections below, summarize the cancer and non-cancer risk characterization results, respectively, for each exposure scenario evaluated for the Northwest Pipe and Casing Superfund Site .

#### *Total Risk and Hazard Results for The Transient Trespasser*

The risks and hazards to the transient trespassing onto the site were calculated assuming a current exposure scenario. These risks and hazards were based on combined ingestion and dermal contact exposures to surface soil, surface water and sediments. The RME cancer risk from all combined exposures is 1.8E-5 and the CT cancer risk from combined exposures is 3.6E-6. Cancer risks are primarily due to dermal contact with soil, due to exposures to 5 carcinogenic PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and dibenz(a,h)anthracene) and total PCBs, and soil ingestion, due to 2 carcinogenic PAHs (benzo(a)pyrene and dibenz(a,h)anthracene) and total PCBs.

The noncarcinogenic hazard from all combined exposures is 15 for the RME scenario and 3 for the CT scenario. For the RME case, this hazard quotient was virtually entirely due to dermal contact with and ingestion of soil containing the PCB Aroclor 1254.

The RME cancer risk falls within the middle of the target risk goal range of 1E-4 to 1E-6. The RME hazard of 15 significantly exceeds the target HQ of 1.0.

***Total Risk and Hazard Results for The On-site Construction Worker***

The risks and hazards to a future construction worker on the site were calculated. These risks and hazards were based on combined ingestion, dermal contact and inhalation exposures to surface and subsurface soils. The total incremental RME cancer risk from all combined exposures is 2.5E-5 and the total incremental CT cancer risk from combined exposures is 6.0E-6. Cancer risks are primarily due to dermal contact with soil, due to exposures to 6 carcinogenic PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene and dibenz(a,h)anthracene) and total PCBs, and soil ingestion, due to 3 carcinogenic PAHs (benzo(a)pyrene, benzo(a)anthracene, and dibenz(a,h)anthracene ) and total PCBs.

The noncarcinogenic hazard from all combined exposures is 14 for the RME scenario and 4 for the CT scenario. For the RME case, this hazard quotient was virtually entirely due to dermal contact with and ingestion of soil containing the PCB Aroclor 1254; several metals and PAHs also contributed to this hazard quotient.

The RME cancer risk falls within the middle of the target risk goal range of 1E-4 to 1E-6. The RME hazard of 14 significantly exceeds the target HQ of 1.0.

***Total Risk and Hazard Results for The On-site Maintenance Worker***

The risks and hazards to a future maintenance worker on the site were calculated. These risks and hazards were based on combined ingestion, dermal contact and inhalation exposures to surface and subsurface soils and groundwater. The total incremental RME cancer risk from all combined exposures is 5.0E-4 and the total incremental CT cancer risk from combined exposures is 7.0E-5. Most of the cancer risk is due to dermal contact with surface and subsurface soil, due to exposures to beryllium,7 carcinogenic PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene and dibenz(a,h)anthracene)and PCBs. Additionally, some of the cancer risk was due to ingestion of soil contaminated with 4 carcinogenic PAHs (benzo(a)anthracene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene and dibenz(a,h)anthracene)and PCBs. Ingestion of groundwater contaminated with PCE, TCE, vinyl chloride and arsenic also contributed to cancer risk.

The noncarcinogenic hazard from all combined exposures is 3 for the RME scenario and 2 for the CT scenario. These hazard quotients were virtually entirely due to dermal contact with and ingestion of soil containing the PCB Aroclor 1254.

The RME cancer risk exceeds the target risk goal range of 1E-4 to 1E-6. The RME hazard of 3 exceeds the target HQ of 1.0.

***Total Risk and Hazard Results for The Off-site Adult Resident***

The risks and hazards to a future adult living off-site were calculated. These risks and hazards were

based on combined ingestion, dermal contact and inhalation exposures from groundwater used as a source of tap water for indoor use. The total incremental RME cancer risk from all combined exposures is 1.0E-3 and the total incremental CT cancer risk from combined exposures is 9.3E-5. Most of the cancer risk is due to ingestion of PCE and vinyl chloride in groundwater. Additional cancer risks includes those from ingestion of arsenic and TCE in groundwater, and from dermal contact with PCE, TCE and vinyl chloride.

The noncarcinogenic hazard from all combined exposures is 2 for the RME scenario and less than 1 for the CT scenario. These hazard quotients are associated with several metals and several VOCs. The RME cancer risk significantly exceeds the target risk goal range of 1E-4 to 1E-6. The RME hazard of 2 exceeds the target HQ of 1.0.

***Total Risk and Hazard Results for the Off-site Child Resident***

The risks and hazards to a future child living off-site were calculated. These risks and hazards were based on combined ingestion, dermal contact and inhalation exposures from groundwater used as a source of tap water for indoor use. The total incremental RME cancer risk from all combined exposures is 5.9E-4 and the total incremental CT cancer risk from combined exposures is 6.1E-5. Most of the cancer risk is due to ingestion of PCE and vinyl chloride in groundwater.

The noncarcinogenic hazard from all combined exposures is 3 for the RME scenario and 1 for the CT scenario. These hazard quotients are associated with several metals and several VOCs.

The RME cancer risk to The off-site child resident exceeds the target risk goal range of 1E-4 to 1E-6. The RME hazard of 3 exceeds the target HQ of 1.0.

### 6.3.5 Risk Assessment Uncertainties

The purpose of a risk assessment is not to predict the actual risk of exposure to an individual. Rather, risk assessments are a management tool for developing conservative estimates of health hazards in order to be protective for the majority of the population and to compensate for uncertainties inherent in estimating exposure and toxicity. As a result, the numerical estimates in a risk assessment (risk values) have associated uncertainties reflecting the limitations in available knowledge about site contaminant concentrations, exposure assumptions (e.g.', chronic exposure concentrations, intake rates) and chemical toxicity. This section discusses the most significant sources of uncertainties in the risk assessment for the Northwest Pipe and Casing Company site.

#### *6.3.5.1 Data Collection and Evaluation*

Many groundwater and soil samples were collected based on the location of known or suspected areas of contamination. Therefore, these samples may disproportionately represent more contaminated areas of the site. This will tend to overestimate the exposure concentrations of contaminants and therefore exposures and consequently risks may be overestimated.

Historical surface soil sample results from prior site investigations were included in the risk assessment because a low number of surface soil samples were collected in the 1997 RI. These historical samples showed substantially higher concentrations of PAHs than the RI samples. Since the historical samples were collected approximately 10 years ago, they may not represent site conditions as accurately as the1997 samples. Therefore, inclusion of these samples may lead to an overestimate of exposure point concentrations and resulting risks.

Contaminants which were not detected in any samples from a given medium were eliminated from consideration in the risk assessment. However, these contaminants may contribute to actual risks if they are present at concentrations in excess of risk-based values. The omission of these contaminants from quantitative analyses may result in an underestimate of risks, but only if these chemicals were actually present. Due to the sample quantitation limits associated with these specific analyses, it is not known if these contaminants are actually present at the site in amounts potentially harmful to human health.

Background concentrations of some inorganic COPCs (e.g., arsenic and beryllium) are substantial, and therefore, may contribute substantially to the measured concentrations. Therefore, site-specific risk estimates will represent risks from the site plus those from background, resulting in an overestimate of the site-related risks.

### *6.3.5.2 Exposure*

Some of the exposure parameters selected to represent the human receptors and their behaviors were based on extrapolation of values applicable to different human receptors. For example, a construction worker was assumed to receive a similar dose of ingested soil as a person working in their yard -- 480 mg of soil in a day. A standard default soil consumption value for people in general is actually 100 mg/day. Use of this higher extrapolated value may result in an overestimate of actual risk.

The skin surface area exposed to contaminants used in the risk assessment was calculated for construction and maintenance workers assuming exposure of only heads, hand and forearms and, consequently, may underestimate risks to those individuals who may have more skin exposed.

EPA's default exposure duration of 25 years was used for the maintenance worker. Since an individual may not hold the same job for 25 years, risks to the maintenance worker may be overestimated.

Since chemical-specific values were not available for all COPCs for dermal absorption factors, gastro-intestinal absorption efficiencies, and dermal permeability constants, surrogate values were used. This may result in under- or overestimation of actual risks.

### *6.3.5.3 Toxicity Assessment and Risk Calculations*

The risk and hazard calculations combine uncertainties in the data evaluation, exposure assessment and toxicity assessment sections. Surrogate toxicity values were used to estimate noncancer toxicity of Aroclors 1248 and 1260, which could result in over- or underestimates of risks from exposure to soil and sediment. Also, cancers risks from PCBs were assessed using the highest end of the range of cancer slope factors. This selection helps to account for persistence and bioaccumulation, but it may overestimate risks at the site. Five COPCs (benzo(g,h,i)perylene, phenanthrene, 2-methylnaphthalene, acenaphthylene, and lead) lacked both carcinogenic and noncarcinogenic toxicity values for quantitative evaluation. Therefore, total cancer and noncancer impacts from COPCs at the site may be underestimated.

### 6.3.6 Conclusions

Using the most up-to-date methods of risk assessment, which conservatively evaluate the potential for risk, this baseline risk assessment found unacceptable carcinogenic and noncancer risks for current transient trespassers exposed to PAHs and PCBs via combined ingestion and dermal contact with soil at the site. Under future exposure scenarios, this baseline risk assessment also found unacceptable cancer risks to an on-site maintenance worker, primarily through exposure to PAHs and PCBs via dermal contact with soil; unacceptable noncancer risks to an on-site construction worker, primarily through exposure to PAHs and PCBs via dermal contact with and ingestion of soil; and unacceptable cancer risks to off-site adult and child residents exposed to PCE and vinyl chloride via combined ingestion of, dermal contact with and inhalation of volatiles emitted from groundwater during all indoor use of tap water.

Note: As explained in Section 5, the scope of this ROD is for response actions for soil contamination. A separate groundwater ROD is expected to be issued in 2001, following further groundwater investigation. Since contaminated groundwater at the site is not currently used by people, EPA does not plan to impose on-site groundwater use restrictions prior to the issuance of the groundwater ROD. EPA will address groundwater response actions, including use restrictions, in the groundwater ROD.

## 6.4 ECOLOGICAL RISK ASSESSMENT

### 6.4.1 Introduction

This section summarizes the results of an ecological risk assessment conducted for the Northwest Pipe and Casing Company site. A screening level assessment initially was conducted to clarify the need for a more detailed risk evaluation or the necessity for an interim cleanup action. This screening assessment identified: 1) chemicals in soil, groundwater, surface water and sediment which exceeded toxicity benchmarks or background levels; 2) ecological receptors, including more sensitive species, documented or potentially present in the site vicinity; and 3) potential pathways for exposure to these chemicals. Based on the results of the screening assessment, a detailed baseline risk assessment was then conducted.

### 6.4.2 Data evaluation

The available sampling results for each affected environmental medium (e.g., soil, groundwater, surface water, sediment) were evaluated to identify a list of chemicals, referred to as the chemicals of potential ecological concern (CEPCs), to be carried through the remainder of the risk assessment. The CEPCs were identified through a screening process which compared the maximum chemical concentrations detected in the different media with toxicity benchmarks (for individual and population level effects) or background concentrations.

A list of the CEPCs identified for soil, groundwater, surface water and sediment at the Northwest Pipe and Casing Company site is presented in **Table 6-16**.

### 6.4.3 Exposure Assessment

This section describes the ecological habitats and receptors at the site, assessment and measurement endpoints, the conceptual site model and exposure values.

#### *6.4.3.1 Habitats and Receptors*

Parcel A lacks any significant ecological habitat due to its nearly complete cover with buildings and pavement. Vegetation on Parcel B is relatively uniform and lacks diversity, due to the extensive past disturbances from pipe coating operations. Approximately 40 percent of Parcel B consists of pavement, angular to subangular gravel or barren soil. The majority of the vegetated areas on Parcel B are dominated by Himalayan blackberry and black cottonwood.

Mammals directly observed at the site include deer mice, eastern cottontail, and raccoon.
A variety of migratory and non-migratory avian species, such as the American crow, killdeer, scrub jay and song sparrow, were observed at the site.

Surface waters and bottom substrates of the adjacent drainage channels do not provide significant habitat to aquatic organisms. The mosquitofish was the only fish species observed in the drainage channels.

Dean Creek and Mt. Scott Creek downstream from the site provide wildlife habitat for resident and anadromous fish species. Mt. Scott Creek flows northward into Kellogg Creek which flows into the Willamette River. Mt. Scott and Kellogg Creeks are located within the designated critical habitat areas for the Lower Columbia River steelhead (*Onchorynchus mykiss*), a federally threatened species, the Lower Columbia River/Southwest Washington coho salmon (*Onchorynchus kisutch* ), a candidate for federally threatened listing, the Lower Columbia River/Southwest Washington cutthroat trout ( *Onchorynchus clark clarki*), proposed for listing as federally threatened, and the Columbia River bull trout (*Salvelinus confluentus*), a federally threatened species.

#### *6.4.3.2 Assessment and Measurement Endpoints*

Assessment endpoints are explicit expressions of the specific ecological receptors and associated functions or qualitites that are to be maintained or protected. Each assessment endpoint represents a specific receptor population (or community) and function of interest and value to risk managers. Multiple assessment endpoints are chosen for a site evaluation and are usually selected to represent different trophic levels within a food web. The assessment endpoints are the foundation of the ecological risk assessment because they provide the basis for assessing the potential risks to ecological receptors.

Assessment endpoints selected for the Northwest Pipe and Casing Company site are presented in **Table 6-17**. These endpoints are representative of the categories of receptors and trophic levels present on or adjacent to the site, and include both aquatic and terrestrial habitats. Some of these endpoints were selected to be surrogate species, representing the exposure that similar species with comparable feeding habits may be receiving.

The assessment endpoints for Dean and Mt. Scott Creeks downstream from the site include the protection of the benthic invertebrate community in the creek sediments, and protection of fish populations, as represented by the mosquitofish. The drainage channels immediately adjacent to the site were not evaluated in the risk assessment for protection of aquatic life since these channels do not represent a valued aquatic habitat. Also, protection of piscivorous bird populations, as represented by the great blue heron, was selected as an assessment endpoint.

In terrestrial habitats associated with the site, potential ecological receptors include plants, birds and mammals. Assessment endpoints selected include protection of: plant communities; the Nelson's checker-mallow, a federally threatened plant potentially present based on habitat type, but not actually observed on-site; herbivorous birds (i.e., California quail); carnivorous birds (red-tailed hawk); insectivorous mammals (i.e., vagrant shrew); and herbivorous mammals (i.e., deer mice).

Measurement endpoints are used to document actual or predicted responses of the assessment endpoints to chemical stressors. For example, the reproductive effects of a chemical on small mammals are predicted by comparing exposure dose estimates (measures of exposure) to literature-based toxicity data for reproductive effects (measures of toxicity). In the Northwest Pipe and Casing Company risk assessment, the measurement endpoints focus on modeled estimates of exposure and toxicological data found in the literature, and include chemical data collected for the site. Measurement endpoints selected to evaluate assessment endpoints in this risk assessment are presented in **Table 6-17**.

### *6.4.3.3 Conceptual Site Model*

A conceptual site model is a representation of the fate and transport of site-related chemicals relative to specific media (e.g., soil, surface water) and receptors (e.g., fish). Information on

receptors and their habitats, chemicals of concern, exposure pathways, and selected assessment and measurement endpoints are integrated into the conceptual model. The ecological conceptual site model for the Northwest Pipe and Casing Company site, showing the significant exposure routes, is presented in **Figure 6-2.**

#### *6.4.3.4 Exposure Analysis*

The exposure analysis characterizes and quantifies the exposure potential defined in the conceptual site model. The evaluation methodologies differ depending on the receptor, and whether a population-level, community-level, or individual-level assessment is conducted. These methodologies are presented in the following discussion.

Population-level analyses were conducted for the following receptors: mosquitofish, great blue heron, deer mouse, vagrant shrew, California quail, and red-tailed hawk. Exposure point values (EPVs), expressed as doses (mg/kg-day) for birds and mammals, and as chemical concentrations in surface water (mg/L) for fish were calculated for each receptor using exposure equations and Monte Carlo simulation techniques . The media that were evaluated for each receptor species include:

- Great blue heron--surface water, sediment, fish tissue, groundwater.
- Deer mouse--soil, plant seeds.
- Vagrant shrew--soil, soil invertebrates.
- California quail--soil, plant seeds.
- Red-tailed hawk--small mammals.
- Mosquitofish--surface water.

Community-level analyses of terrestrial plants and aquatic benthic invertebrates were conducted. EPVs were calculated based on the 90th upper confidence limit of the mean (UCL) of soil and sediment concentrations.

An individual-level analysis was conducted for the Nelson's checker-mallow, a federally threatened plant which could be present at the site based on habitat requirements. Since the Nelson's checker-mallow is a protected species, the analysis was done on an individual-level. The EPV were represented by the maximum CPEC soil concentrations. A plant survey at the site performed after the risk assessment did not detect the presence of Nelson's checker-mallow.

### 6.4.4 Ecological Response Analysis

This section presents information on the toxicity of the chemicals of potential concern to ecological receptors. The toxicity information, obtained from appropriate toxicity databases, is used to develop exposure benchmark values for the selected species or communities. Exposure benchmark values (EBVs) are toxicity-based estimates of threshold values of chemicals below which it is unlikely an ecological receptor will experience adverse effects. EBVs were determined for each of the receptor categories.

EBVs for mammals and birds are expressed in terms of a dose in mg/kg-day. In deriving the EBVs, data for chronic toxicity were preferentially used, when available. In the absence of data from chronic studies, subchronic or acute data was used. EBVs for fish are expressed as a water concentration in mg/L. EBVs for benthic invertebrates and plants are expressed in terms of a sediment or soil concentration in mg/kg.

### 6.4.5 Risk Characterization

The potential for adverse impacts to ecological receptors at the Northwest Pipe and Casing Company site was characterized by evaluation of each assessment endpoint. As noted above, this was accomplished through a population-level assessment for mammals, birds, and fish, a community-level assessment for plants and benthos, and an individual-level assessment for the threatened plant species.

Population-level risk estimates involve estimating local population abundance of the endpoint species, calculating the probability of an exposure exceeding the benchmark (EPV>EBV), and calculating The number of individuals in a local population of an endpoint species that have greater than 10 percent chance of the EPV exceeding the EBV.

The potential risks to ecological communities (i.e., terrestrial plant and aquatic benthic invertebrate communities) and individuals (i.e., Nelson's checker-mallow) were assessed by comparing the media-specific concentrations with EBVs. This comparison, described as a hazard quotient, was made for each CPEC. Hazard quotients do not measure actual risks nor can they be used to determine quantitative risk. HQs less than 1.0 indicate that adverse effects are unlikely to occur to a given receptor. HQs greater than 1.0 indicate that the community or species may be at risk from an adverse effect from that chemical.

### 6.4.6 Risk Description

This sections describes the risk estimates for each of the assessment endpoints.

#### *6.4.6.1 Benthic Invertebrate Community*

Using the HQ method of evaluation, EBVs were slightly exceeded for PAHs and PCBs. Exceedances were not high and ranged from 1.4 times higher for PCBs to 5.7 times higher than the

EBV for pyrene. The results indicate a slight potential for adverse effects to occur to benthic communities in Dean and Mount Scott Creeks.

#### *6.4.6.2 Fish*

The risk estimates indicate that adverse effects to mosquitofish in Dean and Mount Scott Creeks may be occurring based on greater than 20 percent of the population would have a greater than 10 percent chance of the EPV exceeding the EBV for manganese and mercury. Mercury was detected in one of six samples from the creeks, but was not detected in any samples from the drainage ditches adjacent to the site. Mercury was not known to be used during site operations.

#### *6.4.6.3 Piscivorous Birds*

The risk estimates for the great blue heron indicate that none of the herons feeding in on- and off-site surface waters would have greater than 10 percent chance of the EPV exceeding the EBV. No adverse effects are expected in the reproductive capabilities or growth of great blue heron populations that may have contact with the site.

#### *6.4.6.4 Terrestrial Plants*

The calculated HQs show exceedances of EBVs on both the community- and individual -level, with the larger exceedances occurring on the individual-level. Exceedances for inorganic constituents were, in some cases such as aluminum and vanadium, quite large. These results indicate the potential for adverse effects to occur to terrestrial plant communities on Parcel B. However, when viewed in the context of reference soil values, in which background soil concentrations also exceeded the EBVs, the significance of EBV exceedances as indicative of adverse effects from site-related contaminants is questionable. It is possible that part, and in some cases, most, of this risk is due to background levels of metals. Observations at the site have shown limited cases of stressed vegetation are present, notably less than five dead or dying white oak located immediately west of Plant 1.

On the individual-level (i.e., the federally threatened plant Nelson's checker-mallow), calculated HQs exceeded 1 for PAHs, PCBs and metals. Nelson's checker-mallow has not been observed at the site, rather this assessment endpoint was proposed based on the potential for the plant to be present based on its range and habitat requirements. A plant survey conducted at the site after this risk assessment was completed and during the expected blooming period found no Nelson's checker-mallow plants present. Therefore, no adverse impacts to it are expected.

#### *6.4.6.5 Herbivorous Birds*

The risk assessment for the California quail population indicate that greater than 20 percent of the population would have a greater than 10 percent chance of the EPV exceeding the EBV for iron (62

percent) and PCBs (68 percent).

#### *6.4.6.6 Herbivorous Small Mammals*

The risk estimates for the deer mouse, which was used as a surrogate for the herbivorous small mammal populations, indicate that greater than 20 percent of the population would have a greater than 10 percent chance of the EPV exceeding the EBV for iron (74 percent), lead (34 percent), nickel (65 percent), zinc (88 percent), pyrene (21 percent) and PCBs (25 percent).

In an April 1997 small mammal trapping effort at the site, all captured animals were deer mice. Deer mice were abundant at the site, and there were no indications that adverse population effects were occurring. Thus, although the quantitative analysis indicates the potential for adverse effects to herbivorous small mammal populations at the site, the observed abundance of deer mice at the site would suggest that no impacts are occurring relative to reproduction and growth.

#### *6.4.6.7 Insectivorous Small Mammals*

The risk estimates for the vagrant shrew, which was used as a surrogate for the insectivorous small mammal populations, indicate that greater than 20 percent of the population would have a greater than 10 percent chance of the EPV exceeding the EBV for aluminum (100 percent), iron (84 percent), lead (94 percent), nickel (80 percent), selenium (70 percent), zinc (95 percent), fluoranthene (56 percent), phenanthrene (56 percent), pyrene (54 percent), dioxins/furans (100 percent) and PCBs (76 percent). Thus the results indicate the potential for adverse population-level impacts to occur to insectivorous small mammals. A portion of the exceedances for metals may be associated with background concentrations.

#### *6.4.6.8 Raptors*

The risk estimates for the red-tailed hawk population indicate that for bioaccumulative chemicals, no hawks would have a greater than 10 percent chance of the EPV exceeding the EBV. Thus, the results indicate that no adverse population-level effects are expected for raptors from exposures at the Northwest Pipe and Casing Company site.

### 6.4.7 Risk Assessment Uncertainties

Virtually every step in the ecological risk assessment process involves numerous assumptions which may contribute to the total uncertainty on the final evaluation of risk. This section briefly describes some of the major uncertainties that may effect the risk estimates for ecological receptors.

A major uncertainty is whether or not some of the CPECs (particularly the metals) represent background levels. Chemicals which had a maximum detected concentration less than the concentration in background were not selected as CPECs. Since this is not a statistical approach, it is possible that some of the chemicals were retained as CPECs even though they are representative

of background concentrations. For example, aluminum and vanadium resulted in high hazard quotients when evaluating terrestrial plants, but the on-site soil concentrations are very close to background levels.

In the exposure assessment, numerous assumptions were made to estimate EPVs for the selected receptor species. Since limited site-specific information on uptake factors was available, literature-based values were used. These values may under- or over-estimate actual site-specific uptake factors. Exceedances of EBVs for many of the receptors were due to metals. The metals concentration in media at the site were analyzed as total metals, and thus the actual form of the metal in these media is unknown. As a general rule, the more bioavailable forms of chemicals, such as soluble salts, are used in toxicity tests. Thus, it is possible that the form of metal in various site media are in less bioavailable forms than those used in the study on which EBVs are based. In such a case, exposure and subsequent risk to such a chemical would be over-estimated.

In the ecological response estimation, much of the data from literature sources were not specific to the indicator receptor species selected, and therefore, extrapolation of the available data to the species of concern was conducted. Variations in species sensitivities, even among closely related species, to chemicals may vary and therefore cause the extrapolation factors to be either low or high.

For the most part, assumptions used in the risk assessment are likely to have over-estimated, rather than under-estimated ecological risk.

### 6.4.8 Conclusions

The ecological risk assessment results indicate that adverse effects are not likely to occur to raptors feeding on small mammals at the site or to piscivorous birds that feed in the on-site drainage channels or off-site creeks. Terrestrial plant communities, herbivorous birds, herbivorous mammals and insectivorous mammals may experience impacts. Benthic communities in the off-site creeks may experience minimal effects. CPECs accounting for the projected risks associated with soil include PAHs, PCBs, tetrachloroethene and some metals. However, a major portion of risks from metals is likely due to natural background levels.

Note: Subsequent to completion of the ecological risk assessment, EPA conducted an informal consultation under the Endangered Species Act with the National Marine Fisheries Service (NMFS) concerning the selected soil remedy. EPA determined that implementation of the selected soil remedy would not likely adversely affect listed threatened or endangered species, including Lower Columbia River steelhead (*Onchorynchus mykiss*), Lower Columbia River/Southwest Washington coho salmon (*Onchorynchus kisutch* ), Lower Columbia River/Southwest Washington cutthroat trout ( *Onchorynchus clark clarki*) and the Columbia River bull trout (*Salvelinus confluentus*), or the designated critical habitats of these species. EPA's determination of no adverse impacts is based on inclusion of erosion control measures in the soil remedy to minimize degradation of downstream surface water quality and aquatic habitat.

The NMFS has concurred with EPA's determination of no adverse effects. NMFS concurrence completes the informal consultation process and no formal consultation process is required.

**Table 6-1**
**Surface Soil COPCs and their Exposure Point Concentrations**

| Chemical of Potential Concern | Frequency of Detection % | Maximum Detected Concentration mg/kg | Reasonable Maximum Exposure | | Central Tendency | |
|---|---|---|---|---|---|---|
| | | | Concentration mg/kg | Statistical Measure | Concentration mg/kg | Statistical Measure |
| Acenaphthene | 43 | 1,300 | 209.50 | 95% UCL | 102.24 | Mean |
| Anthracene | 48 | 27,000 | 3,765.25 | 95% UCL | 1,540.22 | Mean |
| Antimony | 20 | 26 | 18.16 | 95% UCL | 9.51 | Mean |
| Aroclor 1254 | 86 | 870 | 275.61 | 95% UCL | 174.78 | Mean |
| Arsenic | 100 | 13 | 9.42 | 95% UCL | 4.76 | Mean |
| Barium | 100 | 1,580 | 1,030.63 | 95% UCL | 400.10 | Mean |
| Benzo(a)anthracene | 88 | 950 | 243.18 | 95% UCL | 132.73 | Mean |
| Benzo(a)pyrene | 86 | 410 | 91.00 | 95% UCL | 54.48 | Mean |
| Benzo(b)fluoranthene | 86 | 800 | 166.40 | 95% UCL | 96.87 | Mean |
| Benzo(g,h,i)perylene | 71 | 390 | 73.58 | 95% UCL | 41.95 | Mean |
| Benzo(k)fluoranthene | 81 | 530 | 128.96 | 95% UCL | 75.70 | Mean |
| Chromium | 100 | 124 | 92.92 | 95% UCL | 54.10 | Mean |
| Chrysene | 91 | 2,100 | 363.08 | 95% UCL | 182.54 | Mean |
| 4,4'-DDE | 6 | 2.1 | 2.10 | MAX | 2.10 | MAX |
| Dibenz(a,h)anthracene | 48 | 89 | 34.51 | 95% UCL | 23.28 | Mean |
| Dibenzofuran | 19 | 830 | 138.98 | 95% UCL | 70.14 | Mean |
| Fluoranthene | 86 | 21,000 | 3,262.37 | 95% UCL | 1,493.06 | Mean |
| Fluorene | 43 | 2,600 | 551.77 | 95% UCL | 265.52 | Mean |
| Indeno(1,2,3-cd)pyrene | 71 | 250 | 60.62 | 95% UCL | 38.81 | Mean |
| Iron | 100 | 114,000 | 85,180.79 | 95% UCL | 51,940.00 | Mean |
| Manganese | 100 | 950 | 913.59 | 95% UCL | 698.20 | Mean |
| Phenanthrene | 76 | 16,000 | 2,259.60 | 95% UCL | 949.21 | Mean |
| Pyrene | 86 | 15,000 | 2,401.85 | 95% UCL | 1,129.21 | Mean |
| Total PCB | 86 | 870 | 275.61 | 95% UCL | 174.78 | Mean |
| Vanadium | 100 | 115 | 110.98 | 95% UCL | 88.98 | Mean |

Notes: mg/kg - milligrams per kilograms
95% UCL - 95% Upper Confidence Limit

**Table 6-2**

## Combined Surface and Subsurface Soil COPCs and their Exposure Point Concentrations

| Chemical of Potential Concern | Frequency of Detection % | Maximum Detected Concentration mg/kg | Reasonable Maximum Exposure | | Central Tendency | |
|---|---|---|---|---|---|---|
| | | | Concentration mg/kg | Statistical Measure | Concentration mg/kg | Statistical Measure |
| Acenaphthene | 34 | 1,300 | 33.85 | 95% UCL | 19.34 | Mean |
| Anthracene | 44.2 | 27,000 | 480.05 | 95% UCL | 204.28 | Mean |
| Antimony | 8.3 | 26 | 1.77 | 95% UCL | 1.28 | Mean |
| Aroclor 1254 | 71.9 | 870 | 46.61 | 95% UCL | 31.54 | Mean |
| Arsenic | 80.6 | 31 | 3.47 | 95% UCL | 2.90 | Mean |
| Barium | 99.3 | 1,580 | 148.13 | 95% UCL | 127.60 | Mean |
| Benzo(a)anthracene | 63.1 | 950 | 28.36 | 95% UCL | 17.01 | Mean |
| Benzo(a)pyrene | 59.4 | 410 | 14.19 | 95% UCL | 9.23 | Mean |
| Benzo(b)fluoranthene | 63.6 | 800 | 23.88 | 95% UCL | 14.64 | Mean |
| Benzo(g,h,i)perylene | 46.9 | 390 | 10.41 | 95% UCL | 6.17 | Mean |
| Benzo(k)fluoranthene | 60 | 530 | 18.50 | 95% UCL | 11.39 | Mean |
| Beryllium | 95.1 | 1 | 0.56 | 95% UCL | 0.53 | Mean |
| Cadmium | 30.3 | 33 | 1.44 | 95% UCL | 0.93 | Mean |
| Carbazole | 31.8 | 220 | 7.12 | 95% UCL | 4.33 | Mean |
| Chromium | 98.6 | 836 | 49.61 | 95% UCL | 37.92 | Mean |
| Chrysene | 65.5 | 2,100 | 49.69 | 95% UCL | 26.88 | Mean |
| Copper | 91.5 | 548 | 51.09 | 95% UCL | 41.20 | Mean |
| 4,4'-DDE | 6.2 | 2.1 | 0.48 | 95% UCL | 0.31 | Mean |
| Dibenz(a,h)anthracene | 29.8 | 89 | 5.14 | 95% UCL | 3.44 | Mean |
| Dibenzofuran | 24.1 | 830 | 20.95 | 95% UCL | 11.76 | Mean |
| Fluoranthene | 67.9 | 21,000 | 425.79 | 95% UCL | 206.20 | Mean |
| Fluorene | 32.1 | 2,600 | 77.08 | 95% UCL | 40.06 | Mean |
| Heptachlor | 8 | 0.14 | 0.11 | 95% UCL | 0.06 | Mean |
| Indeno(1,2,3-cd)pyrene | 48.8 | 250 | 9.01 | 95% UCL | 5.89 | Mean |
| Iron | 100 | 469,000 | 46,081.94 | 95% UCL | 38,347.54 | Mean |

## Table 6-2 (cont.)
## Combined Surface and Subsurface Soil COPCs and their Exposure Point Concentrations

| Chemical of Potential Concern | Frequency of Detection % | Maximum Detected Concentration mg/kg | Reasonable Maximum Exposure | | Central Tendency | |
|---|---|---|---|---|---|---|
| | | | Concentration mg/kg | Statistical Measure | Concentration mg/kg | Statistical Measure |
| Manganese | 100 | 8,160 | 869.88 | 95% UCL | 749.13 | Mean |
| Methylene Chloride | 8.1 | 24 | 0.45 | 95% UCL | 0.18 | Mean |
| 2-Methylnaphthalene | 10.8 | 24 | 4.88 | 95% UCL | 3.29 | Mean |
| Nickel | 100 | 582 | 34.70 | 95% UCL | 25.83 | Mean |
| Phenanthrene | 58.5 | 16,000 | 313.46 | 95% UCL | 149.45 | Mean |
| Pyrene | 71.7 | 15,000 | 316.32 | 95% UCL | 158.62 | Mean |
| Tetrachloroethene | 20.8 | 370 | 6.37 | 95% UCL | 2.42 | Mean |
| Thallium | 16.2 | 5 | 0.70 | 95% UCL | 0.62 | Mean |
| 2,3,7,8-TCDD (Equivalents) | 84.6 | .0000304 | 9.65E-05 | 95% UCL | 4.96E-05 | Mean |
| Total PCBs | 71.9 | 870 | 46.62 | 95% UCL | 31.54 | Mean |

Notes: mg/kg - milligrams per kilograms
95% UCL - 95% Upper Confidence Limit

**Table 6-3**
**Groundwater COPCs and their Exposure Point Concentrations**

| Chemical of Potential Concern | Frequency of Detection % | Maximum Detected Concentration mg/l | Reasonable Maximum Exposure | | Central Tendency | |
|---|---|---|---|---|---|---|
| | | | Concentration mg/l | Statistical Measure | Concentration mg/l | Statistical Measure |
| Acenaphthene | 10 | 3.00E-01 | 4.40E-02 | 95% UCL | 1.94E-02 | Mean |
| Acenaphthylene | 5 | 1.00E-03 | 1.00E-03 | MAX | 1.00E-03 | MAX |
| Acetone | 4 | 9.20E-01 | 1.06E-01 | 95% UCL | 4.03E-02 | Mean |
| Arsenic | 35 | 5.00E-03 | 2.52E-03 | 95% UCL | 2.18E-03 | Mean |
| Benzene | 17 | 1.00E-03 | 6.03E-04 | 95% UCL | 5.39E-04 | Mean |
| bis(2-Ethylhexyl)phthalate | 38 | 9.00E-03 | 3.89E-03 | 95% UCL | 3.12E-03 | Mean |
| Cadmium | 13 | 2.00E-03 | 8.63E-04 | 95% UCL | 6.98E-04 | Mean |
| Carbon Tetrachloride | 4 | 2.50E-02 | 3.33E-03 | 95% UCL | 1.58E-03 | Mean |
| Chloroform | 21 | 1.10E-02 | 1.84E-03 | 95% UCL | 1.10E-03 | Mean |
| Dibenzofuran | 10 | 6.90E-02 | 1.26E-02 | 95% UCL | 6.83E-03 | Mean |
| 1,1-Dichloroethene | 17 | 3.00E-03 | 9.68E-04 | 95% UCL | 7.63E-04 | Mean |
| Cis-1,2-Dichloroethene | 54 | 8.50E-01 | 1.40E-01 | 95% UCL | 7.49E-02 | Mean |
| Fluorene | 5 | 7.70E-02 | 1.22E-02 | 95% UCL | 6.05E-03 | Mean |
| Iron | 52 | 3.31E+00 | 1.17E+00 | 95% UCL | 8.13E-01 | Mean |
| Lead | 22 | 1.80E-01 | 2.81E-02 | 95% UCL | 1.50E-02 | Mean |
| Manganese | 100 | 2.52E+00 | 9.19E-01 | 95% UCL | 6.47E-01 | Mean |
| Mercury | 4 | 2.00E-03 | 3.05E-04 | 95% UCL | 1.61E-04 | Mean |
| 2-Methylnaphthalene | 10 | 2.00E-03 | 2.00E-03 | MAX | 2.00E-03 | MAX |
| Phenanthrene | 10 | 1.80E-02 | 4.70E-03 | 95% UCL | 3.40E-03 | Mean |
| Pyrene | 14 | 2.10E-02 | 4.90E-03 | 95% UCL | 3.38E-03 | Mean |
| Tetrachloroethene | 50 | 11.00E+00 | 1.28E+00 | 95% UCL | 4.92E-01 | Mean |
| Thallium | 4 | 1.00E-03 | 1.00E-03 | MAX | 1.00E-03 | MAX |
| 1,1,2-Trichloroethane | 4 | 4.00E-03 | 9.61E-04 | 95% UCL | 7.08E-04 | Mean |
| Trichloroethene | 54 | 3.20E-01 | 5.34E-02 | 95% UCL | 2.89E-02 | Mean |
| Vinyl Chloride | 50 | 1.00E-01 | 1.60E-02 | 95% UCL | 8.48E-03 | Mean |

Notes: mg/l - milligrams per liter
95% UCL - 95% Upper Confidence Limit

## Table 6-4
## Surface Water COPCs and their Exposure Point Concentrations

| Chemical of Potential Concern | Frequency of Detection % | Maximum Detected Concentration mg/l | Reasonable Maximum Exposure | | Central Tendency | |
|---|---|---|---|---|---|---|
| | | | Concentration mg/l | Statistical Measure | Concentration mg/l | Statistical Measure |
| Antimony | 24 | 3.00E-03 | 2.08E-03 | 95% UCL | 1.87E-03 | Mean |
| Chloroform | 14 | 7.00E-04 | 5.19E-04 | 95% UCL | 4.90E-04 | Mean |
| Cis-1,2-Dichloroethene | 76 | 13.00E-03 | 4.25E-03 | 95% UCL | 3.04E-03 | Mean |
| Iron | 100 | 9.00E+00 | 1.85E+00 | 95% UCL | 1.15E+00 | Mean |
| Manganese | 100 | 1.64E+00 | 3.63E-01 | 95% UCL | 2.33E-01 | Mean |
| Tetrachloroethene | 29 | 2.00E-03 | 8.27E-04 | 95% UCL | 6.52E-04 | Mean |
| Thallium | 24 | 4.40E-03 | 4.40E-03 | MAX | 3.90E-03 | Mean |
| Vinyl Chloride | 5 | 5.00E-04 | 5.00E-04 | 95% UCL | 5.00E-04 | Mean |

Notes: mg/l - milligrams per liter
95% UCL - 95% Upper Confidence Limit

## Table 6-5
## Sediment COPCs and their Exposure Point Concentrations

| Chemical of Potential Concern | Frequency of Detection % | Maximum Detected Concentration mg/kg | Reasonable Maximum Exposure | | Central Tendency | |
|---|---|---|---|---|---|---|
| | | | Concentration mg/kg | Statistical Measure | Concentration mg/kg | Statistical Measure |
| Antimony | 64 | 6 | 3.41 | 95% UCL | 2.58 | Mean |
| Aroclor 1248 | 9 | 0.078 | 0.05 | 95% UCL | 0.04 | Mean |
| Aroclor 1254 | 64 | 5.8 | 1.62 | 95% UCL | 0.68 | Mean |
| Aroclor 1260 | 9 | 0.076 | 0.05 | 95% UCL | 0.04 | Mean |
| Arsenic | 82 | 18 | 8.26 | 95% UCL | 5.75 | Mean |
| Benzo(a)anthracene | 73 | 4.2 | 1.45 | 95% UCL | 0.80 | Mean |
| Benzo(a)pyrene | 82 | 4.0 | 1.40 | 95% UCL | 0.76 | Mean |
| Benzo(b)fluoranthene | 82 | 6.5 | 2.29 | 95% UCL | 1.25 | Mean |
| Benzo(g,h,i)perylene | 55 | 0.84 | 0.84 | MAX | 0.84 | MAX |
| Indeno(1,2,3-cd)pyrene | 64 | 2.2 | 0.88 | 95% UCL | 0.55 | Mean |
| Manganese | 100 | 1,210 | 965.49 | 95% UCL | 815.00 | Mean |

## Table 6-5 (cont.)
## Sediment COPCs and their Exposure Point Concentrations

| Chemical of Potential Concern | Frequency of Detection % | Maximum Detected Concentration mg/kg | Reasonable Maximum Exposure | | Central Tendency | |
|---|---|---|---|---|---|---|
| | | | Concentration mg/kg | Statistical Measure | Concentration mg/kg | Statistical Measure |
| Phenanthrene | 64 | 3.30 | 1.45 | 95% UCL | 0.89 | Mean |
| Total PCBs | 82 | 5.80 | 1.63 | 95% UCL | 0.70 | Mean |
| Vanadium | 100 | 154 | 119.43 | 95% UCL | 106.76 | Mean |

Notes: mg/kg - milligrams per kilograms
95% UCL - 95% Upper Confidence Limit

## Table 6-6
## Exposure Factors for Current Transient Trespasser

| Exposure Factors | Surface Soil | | Sediment | | Surface Water | |
|---|---|---|---|---|---|---|
| | RME | CT | RME | CT | RME | CT |
| Body weight (kg) | 70 | 70 | 70 | 70 | 70 | 70 |
| Ingestion rate | 100 mg/day | 100 mg/day | 100 mg/day | 100 mg/day | 2.0 L/day | 1.4 L/day |
| Skin surface area ($cm^2$) | 2,500 | 2,500 | 22,000 | 18,000 | 22,000 | 18,000 |
| Soil-to-skin adherence factor ($mg/cm^2$) | 0.1 | 0.1 | -- | -- | -- | -- |
| Sediment-to-skin adherence factor ($mg/cm^2$) | -- | -- | 0.2 | 0.2 | -- | -- |
| Exposure frequency (days/year) | 183 | 90 | 183 | 90 | 183 | 90 |
| Exposure duration (years) | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Exposure time (hrs/day) - dermal | -- | -- | -- | -- | 0.25 | 0.17 |
| | | | | | | |

**Table 6-7**
**Exposure Factors for Future On-site Maintenance Worker**

| Exposure Factors | Groundwater | | Combined Surface & Subsurface Soil | |
|---|---|---|---|---|
| | RME | CT | RME | CT |
| Body weight (kg) | 70 | 70 | 70 | 70 |
| Ingestion rate | 1.0 L/day | 0.7 L/day | 50 mg/day | 50 mg/day |
| Skin surface area ($cm^2$) | 2,500 | 2,500 | 2,500 | 2,500 |
| Soil-to-skin adherence factor ($mg/cm^2$) | -- | -- | 0.1 | 0.1 |
| Exposure time (hrs/day) | 0.25 | 0.17 | -- | -- |
| Exposure frequency (days/year) | 250 | 250 | 250 | 250 |
| Exposure duration (years) | 25 | 9 | 25 | 9 |
| Inhalation rate ($m^3$/day) | – | – | 20 | 20 |
| Particulate emission factor ($m^3/kg$) | – | – | 6.79E+08 | 6.79E+08 |

**Table 6-8**
**Exposure Factors for Future On-site Construction Worker**

| Exposure Factors | Combined Surface & Subsurface Soil | |
|---|---|---|
| | RME | CT |
| Body weight (kg) | 70 | 70 |
| Ingestion rate | 480 mg/day | 480 mg/day |
| Skin surface area ($cm^2$) | 2,500 | 2,500 |
| Soil-to-skin adherence factor ($mg/cm^2$) | 0.2 | 0.2 |
| Exposure frequency (days/year) | 250 | 125 |
| Exposure duration (years) | 1 | 1 |
| Inhalation rate ($m^3$/day) | 20 | 20 |
| Particulate emission factor ($m^3/kg$) | 6.79E+08 | 6.79E+08 |

**Table 6-9**
**Exposure Factors for Future Adult and Child Off-site Resident**

| Exposure Factors | Groundwater | | | |
|---|---|---|---|---|
| | Adult | | Child | |
| | RME | CT | RME | CT |
| Body weight (kg) | 70 | 70 | 15 | 15 |
| Ingestion rate (L/day) | 2.0 | 1.4 | 1.0 | 0.7 |
| Skin surface area ($cm^2$) | 22,000 | 18,000 | 7,500 | 6,000 |
| Exposure frequency (days/year) | 350 | 350 | 350 | 350 |
| Exposure duration (years) | 24 | 7 | 6 | 2 |
| Exposure time (hrs/day) - dermal | 0.25 | 0.17 | 0.25 | 0.17 |
| Inhalation rate ($m^3$/day) | 15 | 15 | 18 | 18 |
| Volatilization factor | 0.0005 | 0.0005 | 0.0005 | 0.0005 |

**Table 6-10**
**Cancer Toxicity Data, Oral/Dermal**

| Chemical of Potential Concern | Oral Cancer Slope Factor (3) | Oral to Dermal Adjustment Factor (4,5) | Adjusted Dermal Cancer Slope Factor (1) | Units | Weight of Evidence Cancer Guideline Description | Source | Date (2) |
|---|---|---|---|---|---|---|---|
| Acenaphthene | NA | 0.31 | NA | NA | NA | NA | NA |
| Acenaphthylene | NA | 0.31 | NA | NA | D | IRIS | 02/23/98 |
| Acetone | NA | 0.83 | NA | NA | D | IRIS | 02/23/98 |
| Anthracene | NA | 0.76 | NA | NA | D | IRIS | 02/23/98 |
| Antimony | NA | 0.02 | NA | NA | NA | NA | NA |
| Aroclor 1248 | NA | NA | NA | NA | NA | NA | NA |
| Aroclor 1254 | NA | NA | NA | NA | NA | NA | NA |
| Aroclor 1260 | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | 1.5E+0 | 0.41 | 3.7E+0 | 1/(mg/kg-day) | A | IRIS | 02/23/98 |
| Barium | NA | 0.07 | NA | NA | NA | NA | NA |
| Benzene | 2.9E-2 | 0.97 | 3.0E-2 | 1/(mg/kg-day) | A | IRIS | 02/24/98 |
| Benzo(a)anthracene | 7.3E-1 | 0.31 | 2.4E+0 | 1/(mg/kg-day) | B-2 | IRIS | 02/23/98 |
| Benzo(a)pyrene | 7.3E+0 | 0.31 | 2.4E+1 | 1/(mg/kg-day) | B-2 | IRIS | 02/23/98 |
| Benzo(b)fluoranthene | 7.3E-1 | 0.31 | 2.4E+0 | 1/(mg/kg-day) | B-2 | IRIS | 02/23/98 |
| Benzo(g,h,i)perylene | NA | 0.31 | NA | NA | D | IRIS | 02/23/98 |
| Benzo(k)fluoranthene | 7.3E-1 | 0.31 | 2.4E+0 | 1/(mg/kg-day) | B-2 | IRIS | 02/23/98 |
| Beryllium | 4.3E+0 | 0.01 | 4.3E+2 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| bis(2-ethylhexyl)phthalate | 1.4E-2 | 0.19 | 7.4E-2 | 1/(mg/kg-day) | B-2 | IRIS | 05/01/98 |
| Cadmium | NA | 0.01 | NA | NA | B-1 | IRIS | 02/24/98 |
| Carbazole | 2E-2 | 0.7 | 2.9E-2 | 1/(mg/kg-day) | B-2 | HEAST | 07/97 |
| Carbon Tetrachloride | 1.3E-1 | 0.65 | 2.0E-1 | 1/(mg/kg-day) | B-2 | IRIS | 35850 |
| Chloroform | 6.1E-3 | 0.2 | 3.1E-2 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| Chromium | NA | 0.02 | NA | NA | A | IRIS | 02/24/98 |
| Chrysene | 7.3E-3 | 0.31 | 2.4E-2 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| Copper | NA | 0.3 | NA | NA | D | IRIS | 02/24/98 |
| 4,4'-DDE | 3.4E-1 | 0.70 | 4.9E-1 | 1/(mg/kg-day) | B-2 | IRIS | 05/01/98 |
| Dibenz(a,h)anthracene | 7.3E+0 | 0.31 | 2.4E+1 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| Dibenzofuran | NA | 0.5 | NA | NA | D | IRIS | 02/24/98 |
| 1,1-Dichloroethene | 6E-1 | 1 | 6.0E-1 | 1/(mg/kg-day) | C | IRIS | 02/24/98 |

## Table 6-10 (cont.)
## Cancer Toxicity Data, Oral/Dermal

| Chemical of Potential Concern | Oral Cancer Slope Factor (3) | Oral to Dermal Adjustment Factor (4,5) | Adjusted Dermal Cancer Slope Factor (1) | Units | Weight of Evidence Cancer Guideline Description | Source | Date (2) |
|---|---|---|---|---|---|---|---|
| cis-1,2-Dichloroethene | NA | 0.8 | NA | NA | D | IRIS | 02/24/98 |
| Fluoranthene | NA | 0.31 | NA | NA | D | IRIS | 02/24/98 |
| Fluorene | NA | 0.31 | NA | NA | D | IRIS | 02/24/98 |
| Heptachlor | 4.5E+0 | 0.72 | 6.3E+0 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| Indeno(1,2,3-cd)pyrene | 7.3E-1 | 0.31 | 2.4E+0 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| Iron | NA | 0.15 | NA | NA | NA | NA | NA |
| Lead | NA | 0.15 | NA | NA | B-2 | IRIS | 02/24/98 |
| Manganese | NA | 0.04 | NA | NA | D | IRIS | 02/24/98 |
| Mercury | NA | 0.0001 | NA | NA | D | IRIS | 02/24/98 |
| Methylene Chloride | 7.5E-3 | 0.95 | 7.9E-3 | 1/(mg/kg-day) | B-2 | IRIS | 35916 |
| 2-Methylnaphthalene | NA | 0.80 | NA | NA | NA | NA | NA |
| Nickel | NA | 0.27 | NA | NA | A, B-2 | IRIS | 02/24/98 |
| Total PCBs | 2.0, 1.0 | 0.90 | 2.2, 1.1 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| Phenanthrene | NA | 0.73 | NA | NA | D | IRIS | 02/24/98 |
| Pyrene | NA | 0.31 | NA | NA | D | IRIS | 02/24/98 |
| 2,3,7,8-TCDD (Equivlents) | 1.5E+5 | NA | NA | NA | B-2 | HEAST | 07/97 |
| Tetrachloroethene | 5.2E-2 | 1.00 | 5.2E-2 | 1/(mg/kg-day) | C-B2 | NCEA | ___ |
| Thallium | NA | 0.15 | NA | NA | D | IRIS | 02/24/98 |
| 1,1,2-Trichloroethane | 5.7E-2 | 0.81 | 7.0E-2 | 1/(mg/kg-day) | C | IRIS | 02/24/98 |
| Trichloroethene | 1.1E-2 | 0.15 | 7.3E-2 | 1/(mg/kg-day) | C-B2 | NCEA | ___ |
| Vanadium | NA | 0.01 | NA | NA | NA | NA | NA |
| Vinyl Chloride | 1.9 | 1.00 | 1.9E+0 | 1/(mg/kg-day) | A | HEAST | 07/01/97 |

IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NA = Not available in IRIS (EPA 1998a) or HEAST (EPA 1997

Weight of Evidence
Known/likely
Cannot be Determined
Not Likely

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

(1) Adjusted dermal slope factors calculated by dividing unadjusted CSF by the adjustment factor
(2) For IRIS values, provide the date IRIS was searched. For HEAST values, provide the date of HEAST.
(3) Slope factors for carcinogenic PAHs (including benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h anthracene, and indeno(1,2,3-cd)pyrene, were calculated using an equivalency factor approach based on Benzo(a)pyrene (based on EPA 1993a).
(4) Values from Interim Final Guidance Developing Risk-Based Cleanup Levels at Resource Conservation and Recovery Act Sites in Region 10. EPA/910/R-98/001.
(5) In absence of chemical-specific oral to dermal adjustment factors listed in Appendix L (EPA 1998c), default values from Section 4.6.3.6 (EPA 1998c) were used for dibenzofuran and cis- and trans- 1,2-dichloroethene; the value for fluoranthene was used for fluorene.
(6) Values were obtained, in order of preference, from EPA's Integrated Risk Information System (EPA 1998a), EPA's Health Effects Assessment Summary Tables (EPA 1997b), EPA's National Center for Environmental Assessment (EPA, 1998d), and EPA Region IX's PRG Tables (EPA 1998e)

**Table 6-11**
**Cancer Toxicity Data, Inhalation**

| Chemical of Potential Concern | Unit Risk | Units | Adjustment (1) | Inhalation Cancer Slope Factor | Units | Weight of Evidence Cancer Guideline Description | Source (3) | Date (2) |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthylene | NA | NA | NA | NA | NA | D | IRIS | 02/23/98 |
| Acetone | NA | NA | NA | NA | NA | D | IRIS | 02/23/98 |
| Anthracene | NA | NA | NA | NA | NA | D | IRIS | 02/23/98 |
| Antimony | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor 1248 | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor 1254 | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor 1260 | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | 4.5E-3 | $(\mu g/m^3)^{-1}$ | 3500 | 1.6E+1 | 1/(mg/kg-day) | A | IRIS | 02/23/98 |
| Barium | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | 8.3E-6 | $(\mu g/m^3)^{-1}$ | 3500 | 2.9E-2 | 1/(mg/kg-day) | A | IRIS | 02/24/98 |
| Benzo(a)anthracene | NA | NA | NA | NA | NA | B-2 | IRIS | 02/23/98 |
| Benzo(a)pyrene | NA | NA | NA | NA | NA | B-2 | IRIS | 02/23/98 |
| Benzo(b)fluoranthene | NA | NA | NA | NA | NA | B-2 | IRIS | 02/23/98 |
| Benzo(g,h,i)perylene | NA | NA | NA | NA | NA | D | IRIS | 02/23/98 |
| Benzo(k)fluoranthene | NA | NA | NA | NA | NA | B-2 | IRIS | 02/23/98 |
| Beryllium | 2.4E-3 | $(\mu g/m^3)^{-1}$ | 3500 | 8.4E+0 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| bis(2-ethylhexyl)phthlate | NA | NA | NA | NA | NA | NA | NA | NA |
| Cadmium | 1.8E-3 | $(\mu g/m^3)^{-1}$ | 3500 | 6.3E+0 | 1/(mg/kg-day) | B-1 | IRIS | 02/24/98 |
| Carbazole | NA | NA | NA | NA | NA | B-2 | HEAST | 07/97 |
| Carbon Tetrachloride | 1.5E-5 | $(\mu g/m^3)^{-1}$ | 3500 | 5.3E-2 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| Chloroform | 2.3E-5 | $(\mu g/m^3)^{-1}$ | 3500 | 8.1E-2 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| Chromium | 1.2E-2 | $(\mu g/m^3)^{-1}$ | 3500 | 4.2E+1 | 1/(mg/kg-day) | A | IRIS | 02/24/98 |
| Chrysene | NA | NA | NA | NA | NA | B-2 | IRIS | 02/24/98 |
| Copper | NA | NA | NA | NA | NA | D | IRIS | 02/24/98 |
| 4,4'-DDE | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenz(a,h)anthracene | NA | NA | NA | NA | NA | B-2 | IRIS | 02/24/98 |

## Table 6-11(cont.)
## Cancer Toxicity Data, Inhalation

| Chemical of Potential Concern | Unit Risk | Units | Adjustment (1) | Inhalation Cancer Slope Factor | Units | Weight of Evidence Cancer Guideline Description | Source | Date (2) |
|---|---|---|---|---|---|---|---|---|
| Dibenzofuran | NA | NA | NA | NA | NA | D | IRIS | 02/24/98 |
| 1,1-Dichloroethene | 5.0E-5 | $(\mu g/m^3)^{-1}$ | 3500 | 1.8E-1 | 1/(mg/kg-day) | C | IRIS | 02/24/98 |
| cis-1,2-Dichloroethene | NA | $(\mu g/m^3)^{-1}$ | NA | NA | NA | D | IRIS | 02/24/98 |
| Fluoranthene | NA | NA | NA | NA | NA | D | IRIS | 02/24/98 |
| Fluorene | NA | NA | NA | NA | NA | D | IRIS | 02/24/98 |
| Heptachlor | 1.3E-3 | $(\mu g/m^3)^{-1}$ | 3500 | 4.6E+0 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | NA | NA | B-2 | IRIS | 02/24/98 |
| Iron | NA | NA | NA | NA | NA | NA | NA | NA |
| Lead | NA | NA | NA | NA | NA | B-2 | IRIS | 02/24/98 |
| Manganese | NA | NA | NA | NA | NA | D | IRIS | 02/24/98 |
| Mercury | NA | NA | NA | NA | NA | D | IRIS | 02/24/98 |
| Methylene Chloride | 0.00000047 | $(\mu g/m^3)^{-1}$ | 3500 | 1.6E-3 | 1/(mg/kg-day) | B-2 | IRIS | 05/01/98 |
| 2-Methylnaphthalene | NA | NA | NA | NA | NA | NA | NA | NA |
| Nickel | 2.4E-4 | $(\mu g/m^3)^{-1}$ | 3500 | 8.4E-1 | 1/(mg/kg-day) | A | IRIS | 02/24/98 |
| Phenanthrene | NA | NA | NA | NA | NA | D | IRIS | 02/24/98 |
| Pyrene | NA | NA | NA | NA | NA | D | IRIS | 02/24/98 |
| 2,3,7,8-TCDD (Equivalents) | NA | NA | NA | 1.5E+5 | 1/(mg/kg-day) | B-2 | HEAST | 07/97 |
| Tetrachloroethene | 2.9E-7 - 9.5E-7 | $(\mu g/m^3)^{-1}$ | 3500 | 2.0E-3 | 1/(mg/kg-day) | C - B-2 | NCEA | 05/15/98 |
| Thallium | NA | NA | NA | NA | NA | D | IRIS | 02/24/98 |
| Total PCBs | 1E-4 | $(\mu g/m^3)^{-1}$ | 3500 | 3.5E-1 | 1/(mg/kg-day) | B-2 | IRIS | 02/24/98 |
| 1,1,2-Trichloroethane | 1.6E-5 | $(\mu g/m^3)^{-1}$ | 3500 | 5.6E-2 | 1/(mg/kg-day) | C | IRIS | 02/24/98 |
| Trichloroethene | 0.0000017 | $(\mu g/m^3)^{-1}$ | 3500 | 6.0E-3 | 1/(mg/kg-day) | C - B-2 | NCEA | 05/15/98 |
| Vanadium | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl Chloride | 8.4E-5 | $(\mu g/m^3)^{-1}$ | 3500 | 2.9E-1 | 1/(mg/kg-day) | C | IRIS:HEAST | 02/24/98:07/97 |

NA = Not available in IRIS (EPA 1998a) or HEAST (EPA 1997b)
IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

Weight of Evidence:
- Known/Likely
- Cannot be Determined
- Not Likely

EPA Group:
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen
- E - Evidence of noncarcinogenicity

(1) CSFs were derived from unit risks based on a 70 kg body weight and a daily personal inhalation rate of 20 m3/day, per RAGS (EPA 1989a)
(2) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
(3) Values were obtained, in order of preference, from EPA's Integrated Risk Information System (EPA 1998a), EPA's Health Effects Assessment Summary Tables (EPA 1997b). Additional values were obtained from EPA's National Center for Environmental Assessment (EPA, 1998d).

**Table 6-12**
**Noncancer Toxicity Data, Oral/Dermal**

| Chemical of Potential Concern | Chronic/ Subchronic | Oral RfD Value (4) | Oral RfD Units | Oral to Dermal Adjustment Factor (1) | Adjusted Dermal RfD (2) | Units | Primary Target Organ | Combined Uncertainty Modifying Factors | Sources of RfD: Target Organ | Dates of RfD: Target Organ (3) |
|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | Chronic | 6.0E-2 | mg/kg-day | 0.31 | 1.9E-2 | mg/kg-day | liver | 3000 | IRIS:HEAST | 02/23/98:07/97 |
| Acenaphthylene | NA | NA | NA | 0.31 | NA | NA | NA | NA | NA | NA |
| Acetone | Chronic | 1.0E-1 | mg/kg-day | 0.83 | 8.3E-2 | mg/kg-day | liver, kidney | 1000 | IRIS | 02/23/98 |
| Anthracene | Chronic | 3.0E-1 | mg/kg-day | 0.76 | 2.3E-1 | mg/kg-day | NOEL | 3000 | IRIS | 02/23/98 |
| Antimony | Chronic | 4.0E-4 | mg/kg-day | 0.02 | 8.0E-6 | mg/kg-day | whole body, blood | 1000 | IRIS:HEAST | 02/23/98:07/97 |
| Aroclor 1248 | NA | 2.0E-5 | mg/kg-day | 0.90 | 1.8E-5 | mg/kg-day | NA | NA | NA | NA |
| Aroclor 1254 | Chronic | 2.0E-5 | mg/kg-day | 0.90 | 1.8E-5 | mg/kg-day | immune system | 300 | IRIS:HEAST | 02/23/98:07/97 |
| Aroclor 1260 | NA | 2.0E-5 | mg/kg-day | 0.90 | 1.8E-5 | mg/kg-day | NA | NA | NA | NA |
| Arsenic | Chronic | 3.0E-4 | mg/kg-day | 0.41 | 1.2E-4 | mg/kg-day | skin | 3 | IRIS | 02/23/98 |
| Barium | Chronic | 7.0E-2 | mg/kg-day | 0.07 | 4.9E-3 | mg/kg-day | cardiovascular system | 3 | IRIS | 02/23/98 |
| Benzene | NA | 3.0E-3 | mg/kg-day | 0.97 | 2.9E-3 | mg/kg-day | NA | NA | NCEA (per R9) | 05/01/98 |
| Benzo(a)anthracene | NA | NA | NA | 0.31 | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | NA | NA | NA | 0.31 | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | NA | NA | 0.31 | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | NA | NA | NA | 0.31 | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | NA | NA | NA | 0.31 | NA | NA | NA | NA | NA | NA |
| Beryllium | Chronic | 5.0E-3 | mg/kg-day | 0.01 | 5.0E-5 | mg/kg-day | NOEL | 100 | IRIS | 02/24/98 |
| bis(2-ethylhexyl)phthalate | Chronic | 2.0E-2 | mg/kg-day | 0.19 | 3.8E-3 | mg/kg-day | liver, reproductive | 1000 | IRIS | 05/01/98 |
| Cadmium | Chronic -dose in water | 5.0E-4 | mg/kg-day | 0.01 | 5.0E-6 | mg/kg-day | NOEL | 10 | IRIS | 02/24/98 |
| Cadmium | Chronic -dose in food | 1E-3 | mg/kg-day | 0.01 | 1.0E-5 | mg/kg-day | NOEL | 10 | IRIS | 02/24/98 |
| Carbazole | NA | NA | NA | 0.70 | NA | NA | NA | NA | NA | NA |
| Carbon tetrachloride | Chronic | 7.0E-4 | mg/kg-day | 0.65 | 4.6E-4 | mg/kg-day | liver | 1000 | IRIS | 02/24/98 |

**Table 6-12 (cont.)**
**Noncancer Toxicity Data, Oral/Dermal**

| Chemical of Potential Concern | Chronic/ Subchronic | Oral RfD Value (4) | Oral RfD Units | Oral to Dermal Adjustment Factor (1) | Adjusted Dermal RfD (2) | Units | Primary Target Organ | Combined Uncertainty Modifying Factors | Sources of RfD: Target Organ | Dates of RfD: Target Organ (3) |
|---|---|---|---|---|---|---|---|---|---|---|
| Chloroform | Chronic | 1.0E-2 | mg/kg-day | 0.20 | 2.0E-3 | mg/kg-day | liver | 1000 | IRIS | 02/24/98 |
| alpha Chlordane | Chronic | 5.0E-4 | mg/kg-day | 0.50 | 2.5E-4 | mg/kg-day | liver | 300 | IRIS | 02/24/98 |
| Chlorobenzene | Chronic | 2.0E-2 | mg/kg-day | 0.31 | 6.2E-3 | mg/kg-day | liver | 1000 | IRIS | 02/24/98 |
| Chromium | Chronic | 5.0E-3 | mg/kg-day | 0.02 | 1.0E-4 | mg/kg-day | NOEL | 500 | IRIS | 02/24/98 |
| Chrysene | NA | NA | NA | 0.31 | NA | NA | NA | NA | NA | NA |
| Copper | NA | 3.7E-2 | mg/kg-day | 0.30 | 1.1E-2 | mg/kg-day | NA | NA | HEAST (per R9) | 05/01/98 |
| 4,4'-DDE | NA | NA | NA | 0.70 | NA | NA | NA | NA | NA | NA |
| Dibenz(a,h)anthracene | NA | NA | NA | 0.31 | NA | NA | NA | NA | NA | NA |
| Dibenzofuran | NA | 4.0E-3 | mg/kg-day | 0.5 | 2.0E-3 | mg/kg-day | NA | NA | R9 | 05/01/98 |
| 1,1-Dichloroethene | Chronic | 9E-3 | mg/kg-day | 1.00 | 9.0E-3 | mg/kg-day | liver | 1000 | IRIS | 02/24/98 |
| cis-1,2-Dichloroethene | Chronic | 1E-2 | mg/kg-day | 0.8 | 8.0E-3 | mg/kg-day | blood | 3000 | HEAST | 07/97 |
| trans-1,2-Dichloroethene | Chronic | 2E-2 | mg/kg-day | 0.8 | 1.6E-2 | mg/kg-day | blood | 1000 | IRIS | 02/24/98 |
| Fluoranthene | Chronic | 4E-2 | mg/kg-day | 0.31 | 1.2E-2 | mg/kg-day | kidney, liver, blood | 3000 | IRIS:HEAST | 02/24/98:07/97 |
| Fluorene | Chronic | 4E-2 | mg/kg-day | 0.31 | 1.2E-2 | mg/kg-day | blood | 3000 | IRIS | 02/24/98 |
| Heptachlor | Chronic | 5E-4 | mg/kg-day | 0.72 | 3.6E-4 | mg/kg-day | liver | 300 | IRIS | 02/24/98 |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | 0.31 | NA | NA | NA | NA | NA | NA |
| Iron | Chronic | 3.0E-1 | mg/kg-day | 0.15 | 4.5E-2 | mg/kg-day | liver, blood, gastrointestinal | 1 | NCEA | 05/15/98 |
| Lead | NA | NA | NA | 0.15 | NA | NA | NA | NA | NA | NA |
| Manganese | Chronic | 1.4E-1 | mg/kg-day | 0.040 | 5.6E-3 | mg/kg-day | CNS | 1 | IRIS | 02/24/98 |
| Mercury | NA | NA | NA | 0.00 | NA | NA | NA | NA | NA | NA |
| Methylene Chloride | NA | 6.0E-2 | mg/kg-day | 0.95 | 5.7E-2 | mg/kg-day | liver | 100 | IRIS | 05/01/98 |
| 2-Methylnaphthalene | NA | NA | NA | 0.80 | NA | NA | NA | NA | NA | NA |
| Nickel | Subchronic | 2E-2 | mg/kg-day | 0.27 | 5.4E-3 | mg/kg-day | whole body | 300 | IRIS | 02/24/98 |
| Naphthalene | Chronic/ subchronic | 4.0E-2 | mg/kg-day | 0.80 | 3.2E-2 | mg/kg-day | not listed | 1000 | NCEA | 05/15/98 |
| Phenanthrene | NA | NA | NA | 0.73 | NA | NA | NA | NA | NA | NA |
| Pyrene | Chronic | 3E-2 | mg/kg-day | 0.31 | 9.3E-3 | mg/kg-day | kidney | 3000 | IRIS | 02/24/98 |
| 2,3,7,8-TCDD (Equivalents) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | Chronic | 1E-2 | mg/kg-day | 1.00 | 1.0E-2 | mg/kg-day | liver | 1000 | IRIS:HEAST | 02/24/98:07/97 |
| Thallium | Subchronic | 8E-5 | mg/kg-day | 0.15 | 1.2E-5 | mg/kg-day | NOEL | 3000 | IRIS | 02/24/98 |

**Table 6-12 (cont.)**
**Noncancer Toxicity Data, Oral/Dermal**

| Chemical of Potential Concern | Chronic/ Subchronic | Oral RfD Value (4) | Oral RfD Units | Oral to Dermal Adjustment Factor (1) | Adjusted Dermal RfD (2) | Units | Primary Target Organ | Combined Uncertainty Modifying Factors | Sources of RfD: Target Organ | Dates of RfD: Target Organ (3) |
|---|---|---|---|---|---|---|---|---|---|---|
| Total PCBs | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | Chronic | 4E-3 | mg/kg-day | 0.81 | 3.2E-3 | mg/kg-day | blood | 1000 | IRIS | 02/24/98 |
| Trichloroethene | NA | 6.0E-3 | mg/kg-day | 0.15 | 9.0E-4 | mg/kg-day | NA | NA | R9 | 35916 |
| Vanadium | Chronic | 7E-3 | mg/kg-day | 0.01 | 7.0E-5 | mg/kg-day | NA | 100 | HEAST | 07/97 |
| Vinyl Chloride | NA | NA | NA | 1.00 | NA | NA | NA | NA | NA | NA |

NA = Not available in IRIS (EPA 1998a) or HEAST (EPA 1997b)

(1) Values from Interim Final Guidance: Developing Risk-Based Cleanup Levels At RCRA Sites in Region 10. EPA/910/R-98/001.
(2) Adjusted the dermal reference doses by multiplying unadjusted RfD by the adjustment factor

(3) For IRIS values, provide the date IRIS was searched.

For HEAST values, provide the date of HEAST.
(4) The RfD for Aroclor 1254 was used as a surrogate for Aroclors 1248 and 1260.

(5) In absence of chemical-specific oral to dermal adjustment factors listed in Appendix L (EPA 1998c), default values from Section 4.6.3.6 (EPA 1998c) were used for dibenzofuran and cis- and trans- 1,2-dichloroethene; the value for fluoranthene was used for fluorene.
6) Values were obtained, in order of preference, from EPA's Integrated Risk Information System (EPA 1998a), EPA's Health Effects Assessment Summary Tables (EPA 1997b), EPA's National Center for Environmental Assessment (EPA, 1998d), and EPA Region IX's PRG Tables (EPA 1998e)

## Table 6-13
## Noncancer Toxicity Data, Inhalation

| Chemical of Potential Concern | Chronic/ Subchronic | Inhalation RfC Value | Inhalation RfC Units | Adjusted Inhalation RfD (1) | Adjusted Inhalation Units | Primary Target Organ | Combined Uncertainty/Modifying Factors | Sources of RfC:RfD: Target Organ | Dates (2) |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthylene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Antimony | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor 1248 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor 1254 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor 1260 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Barium | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | NA | NA | NA | 1.7E-3 | mg/kg-day | NA | NA | NCEA (per R9) | 5/1/98 |
| Benzo(a)anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Beryllium | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-ethylhexyl)phthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cadmium | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbazole | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon Tetrachloride | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| alpha Chlordane | Chronic | 7.0E-4 | $mg/m^3$ | 2.0E-4 | mg/kg-day | liver | 1000 | IRIS | 02/25/98 |
| Chromium | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chrysene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Copper | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,4'-DDE | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenz(a,h)anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenzofuran | NA | NA | NA | NA | NA | NA | NA | NA | NA |

**Table 6-13 (cont.)**
**Noncancer Toxicity Data, Inhalation**

| Chemical of Potential Concern | Chronic/ Subchronic | Inhalation RfC Value | Inhalation RfC Units | Adjusted Inhalation RfD (1) | Adjusted Inhalation Units | Primary Target Organ | Combined Uncertainty/Modifying Factors | Sources of RfC:RfD: Target Organ | Dates (2) |
|---|---|---|---|---|---|---|---|---|---|
| 1,1-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluorene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Heptachlor | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Lead | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Manganese | Chronic | 5.0E-5 | $mg/m^3$ | 1.4E-5 | mg/kg-day | nervous system | 1000/1 | IRIS | 02/24/98 |
| Mercury | Chronic | 3.0E-4 | $mg/m^3$ | 8.6E-5 | mg/kg-day | nervous system | 30 | IRIS | 02/24/98 |
| Methylene Chloride | Chronic | 3.0E+0 | $mg/m^3$ | 8.6E-1 | mg/kg-day | liver | 100 | IRIS: HEAST | 02/24/98:7/97 |
| 2-Methylnaphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Nickel | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Naphthalene | NA | NA | NA | 8.6E-4 | mg/kg-day | NA | NA | R9 | 5/1/1998 |
| Phenanthrene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,3,7,8-TCDD (Equivalents) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | Chronic | 4.0E-1 | $mg/m^3$ | 1.1E-1 | mg/kg-day | liver, kidney, brain | 30 | NCEA | 5/15/98 |
| Total PCBs | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Thallium | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vanadium | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl Chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA |

NA = Not available in IRIS (EPA 1998a) or HEAST (EPA 1997b)
(1) RfDs were derived from RfCs based on a 70 kg body weight and a daily personal inhalation rate of 20 $m^3$/day, per RAGS (EPA 1989a)

(2) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
(3) Values were obtained, in order of preference, from EPA's Integrated Risk Information System (EPA 1998a), EPA's Health Effects Assessment Summary Tables (EPA 1997b). Additional values were obtained from EPA's National Center for Environmental Assessment (EPA, 1998d) and EPA Region IX's PRG Tables (EPA 1998e)

**Table 6-14**
**Summary of Carcinogenic Human Health Risks**

| Exposure Pathway | Cancer Risk | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Transient Trespasser | | On-site Maintenance Worker | | On-site Construction Worker | | Adult Off-site Resident | | Child Off-site Resident | |
| | RME | CT | RME | CT | RME | CT | RME | CT | RME | CT |
| **Soil-total** | **1.7E-5** | **3.4E-6** | **1.4E-4** | **2.9E-5** | **2.5E-5** | **6.0E-6** | | | | |
| Ingestion | 8.7E-6 | 1.1E-6 | 4.7E-5 | 9.3E-6 | 1.8E-5 | 5.0E-6 | | | | |
| Dermal Contact | 8.4E-6 | 2.3E-6 | 8.8E-5 | 1.9E-5 | 7.1E-6 | 1.1E-6 | | | | |
| Inhalation -Particulate | | | 2.3E-7 | 6.2E-8 | 9.1E-9 | 3.5E-9 | | | | |
| Inhalation-Vapor | | | 3.8E-11 | 5.2E-12 | 1.5E-12 | 2.9E-13 | | | | |
| **Groundwater-total** | | | **3.7E-4** | **4.1E-5** | | | **1.0E-3** | **9.3E-5** | **5.9E-4** | **6.1E-5** |
| Ingestion | | | 3.5E-4 | 4.0E-5 | | | 9.5E-4 | 8.7E-5 | 5.5E-4 | 5.8E-5 |
| Dermal Contact | | | 1.3E-5 | 9.5E-7 | | | 9.1E-5 | 5.9E-6 | 3.6E-5 | 2.6E-6 |
| Inhalation-Vapor | | | | | | | 1.9E-9 | 4.4E-10 | 2.6E-9 | 7.0E-10 |
| **Sediment-total** | **7.8E-7** | **1.6E-7** | | | | | | | | |
| Ingestion | 1.4E-7 | 2.0E-8 | | | | | | | | |
| Dermal Contact | 6.4E-7 | 1.4E-7 | | | | | | | | |
| **Surface Water-total** | 1.0E-7 | 3.5E-8 | | | | | | | | |
| Ingestion | 1.0E-7 | 3.5E-8 | | | | | | | | |
| Dermal Contact | 2.6E-9 | 6.7E-10 | | | | | | | | |
| **Total Across All Pathways** | **1.8E-5** | **3.6E-6** | **5.0E-4** | **7.0E-5** | **2.5E-5** | **6.0E-6** | **1.0E-3** | **9.3E-5** | **5.9E-4** | **6.1E-5** |

**Table 6-15**
**Summary of Noncarcinogenic Human Health Hazards**

| Exposure Pathway | Noncancer Hazard | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Transient Trespasser | | On-site Maintenance Worker | | On-site Construction Worker | | Adult Off-site Resident | | Child Off-site Resident | |
| | RME | CT | RME | CT | RME | CT | RME | CT | RME | CT |
| **Soil-total** | **1E+1** | **3E+0** | **2E+0** | **2E+0** | **1E+1** | **4E+0** | | | | |
| Ingestion | 1E+1 | 2E+0 | 1E+0 | 8E-1 | 1E+1 | 4E+0 | | | | |
| Dermal Contact | 4E+0 | 1E+0 | 1E+0 | 7E-1 | 2E+0 | 3E-1 | | | | |
| Inhalation-Particulate | | | 2E-2 | 2E-2 | 2E-2 | 8E-3 | | | | |
| Inhalation-Vapor | | | 4E-7 | 2E-7 | 4E-7 | 8E-8 | | | | |
| **Groundwater-total** | | | **4E-1** | **2E-1** | | | **1.5E+0** | **6E-1** | **3E+0** | **1E+0** |
| Ingestion | | | 3E-1 | 1E-1 | | | 9E-1 | 4E-1 | 2E+0 | 1E+0 |
| Dermal Contact | | | 8E-2 | 2E-2 | | | 6E-1 | 1E-1 | 9E-1 | 2E-1 |
| Inhalation-Vapor | | | | | | | 7E-3 | 5E-3 | 4E-2 | 3E-2 |
| **Sediment-total** | **6E-1** | **1E-1** | | | | | | | | |
| Ingestion | 9E-2 | 1E-2 | | | | | | | | |
| Dermal Contact | 5E-1 | 1E-1 | | | | | | | | |
| **Surface Water-total** | 2E-1 | 5E-2 | | | | | | | | |
| Ingestion | 2E-1 | 4E-2 | | | | | | | | |
| Dermal Contact | 3E-2 | 7E-3 | | | | | | | | |
| **Total Across All Pathways** | **15** | **3.1** | **2.7** | **1.7** | **14** | **4** | **1.5** | **0.6** | **3.1** | **1.2** |

**Table 6-16**
**Contaminants of Ecological Potential Concern (CEPCs)**

| CEPC | Soil | Groundwater | Surface Water | Sediment |
|---|---|---|---|---|
| Inorganics | | | | |
| Aluminum | T | T | T | T |
| Antimony | T | | | T |
| Arsenic | T | | | T |
| Barium | T | T | T | T |
| Cadmium | T | | | T |
| Chromium | T | | | T |
| Cobalt | T | | | |
| Copper | T | T | | T |
| Iron | T | T | T | |
| Lead | T | T | T | T |
| Manganese | T | T | T | T |
| Mercury | | | T | |
| Nickel | T | | | |
| Selenium | T | T | | T |
| Silver | T | | | |
| Thallium | T | | | |
| Vanadium | T | | | T |
| Zinc | T | | | T |
| Organics | | | | |
| Acetone | | | | T |
| Benzene | | | | |
| Carbon Tetrachloride | | | | |
| Carbazole | T | | | T |
| Di-n-octylphthalate | | | | |

**Table 6-16 (cont.)**
**Contaminants of Ecological Potential Concern (CEPCs)**

| CEPC | Soil | Groundwater | Surface Water | Sediment |
|---|---|---|---|---|
| alpha-BHC | T | | | |
| 4,4'-DDE | T | | | |
| 4,4'-DDD | T | | | |
| 4,4'-DDT | T | | | |
| Endrin | T | | | |
| bis(2-ethylhexyl)phthalate | T | | | |
| Dibenzofuran | T | T | | |
| Heptachlor | T | | | |
| 2,3,7,8-TCDD | T | | | |
| Tetrachloroethene | T | | | |
| Vinyl chloride | T | T | T | |
| PAHs | | | | |
| Acenaphthene | T | T | | |
| Anthracene | | | | T |
| Benzo(a)anthracene | T | | | T |
| Benzo(a)pyrene | T | | | T |
| Benzo(b)fluoranthene | T | | | T |
| Benzo(g,h,i)perylene | T | | | T |
| Benzo(k)fluoranthene | T | | | T |
| Chrysene | T | | | T |
| Dibenz(a,h)anthracene | | | | |
| Fluoranthene | T | T | | T |
| Fluorene | T | T | | |
| Indeno(1,2,3-cd)pyrene | T | | | T |
| 2-Methylnaphthalene | T | | | T |
| Naphthalene | T | | | T |

**Table 6-16 (cont.)**
**Contaminants of Ecological Potential Concern (CEPCs)**

| CEPC | Soil | Groundwater | Surface Water | Sediment |
|---|---|---|---|---|
| Phenanthrene | **T** | **T** | | **T** |
| Pyrene | **T** | **T** | | **T** |
| PCBs | | | | |
| Aroclor 1248 | | | | **T** |
| Aroclor 1254 | **T** | | | **T** |
| Aroclor 1260 | | | | **T** |

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**Table 6-17**
**Ecological Assessment Endpoints and Associated Measures**

| Assessment Endpoint | Endpoint Species | Measures | |
|---|---|---|---|
| | | Exposure | Effect |
| Protection of benthic community in Dean and Mt. Scott Creeks from adverse effects due to chemical exposures. | Freshwater benthic community | • Contaminant levels in sediments | • Estimated exceedance of community-level ecological benchmark values (EBVs) |
| Protection of resident fish in Dean and Mt. Scott Creeks from reductions in population resulting from exposure to chemicals in surface waters. | Mosquitofish | • Contaminant levels in surface water | • Estimated exceedance of population-level EBVs<br>• Estimated exceedance of population-level effect thresholds |
| Protection of piscivorous bird populations from reproductive or growth impairment resulting from exposure to chemicals in drainage channel and creek sediment and surface water. | Great blue heron | • Food chain exposure modeling<br>• Contaminant levels in sediments and surface water<br>• Contaminant levels in food items--fish | • Estimated exceedance of population-level EBVs<br>• Estimated exceedance of population-level effect thresholds |
| Protection of terrestrial plant communities from adverse effects due to chemical exposures. | Terrestrial plant community | • Contaminant levels in soils | • Estimated exceedance of individual-level EBVs |
| Protection of Nelson's checker-mallow, a federally threatened plant, from adverse effects due to chemical exposures. | Nelson's checker-mallow | • Contaminant levels in soils | • Estimated exceedance of individual-level EBVs |

**Table 6-17 (cont.)**
**Ecological Assessment Endpoints and Associated Measures**

| Assessment Endpoint | Endpoint Species | Measures | |
|---|---|---|---|
| | | Exposure | Effect |
| Protection of herbivorous bird populations from reproductive or growth impairment resulting from exposure to chemicals in on-site soils. | California quail | • Food chain exposure modeling<br>• Contaminant levels in surficial soils<br>• Contaminant levels in food items--seeds | • Estimated exceedance of population-level EBVs<br>• Estimated exceedance of population-level effect thresholds |
| Protection of herbivorous small mammal populations from reproductive or growth impairment resulting from exposure to chemicals in on-site soils. | Deer mouse | • Food chain exposure modeling<br>• Contaminant levels in surficial soils<br>• Contaminant levels in food items--seeds | • Estimated exceedance of population-level EBVs<br>• Estimated exceedance of population-level effect thresholds |
| Protection of insectivorous small mammal populations from reproductive or growth impairment resulting from exposure to chemicals in on-site soils. | Vagrant shrew | • Food chain exposure modeling<br>• Contaminant levels in surficial soils<br>• Contaminant levels in food items--soil invertebrates | • Estimated exceedance of population-level EBVs<br>• Estimated exceedance of population-level effect thresholds |
| Protection of raptors from reproductive or growth impairment resulting from exposure to bioaccumulative chemicals in on-site soils. | Red-tailed hawk | • Food chain exposure modeling<br>• Contaminant levels in food items--small mammals | • Estimated exceedance of population-level EBVs<br>• Estimated exceedance of population-level effect thresholds |

# 7.0 REMEDIAL ACTION OBJECTIVES

## 7.1 NEED FOR REMEDIAL ACTION

Current trespassers on Parcel B are at risk from exposure to soil contaminants. Although trespass onto Parcel B is restricted through perimeter fencing, warning signs and periodic security patrols, transient trespass has not been totally eliminated. The results of the baseline human health and ecological risk assessments indicate that current risks to trespassers on the site and future potential risks to construction and maintenance workers at the site are above the acceptable risk levels set under both federal Superfund and Oregon Environmental Cleanup Law regulations. The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment. Consistent with NCP and EPA policy, remedial action is warranted to address these potential risks.

Remedial action objectives (RAOs) consist of medium-specific or location-specific goals for protecting human health and the environment. Soil contaminants of concern (COCs) were selected from the COPCs evaluated in the baseline risk assessment, based on potential human exposures at the site, and include specific chlorinated VOCs, carcinogenic HPAHs, and total PCBs. RAOs were developed for the Northwest Pipe and Casing Company site for these COCs.

## 7.2 RAOs

The following RAOs for soil have been developed for the Northwest Pipe and Casing Company site:

- Prevent exposure of trespassers, future construction workers and future maintenance workers through direct contact (ingestion or dermal contact) with contaminated soil that would result in an excess lifetime cancer risk greater than one in a million (1E-06) for individual carcinogens, above 1E-05 for additive carcinogenic contaminants, or above a Hazard Quotient of 1.

- Prevent migration of soil contaminants to groundwater that would result in exposure to a future off-site resident through direct contact (ingestion, inhalation and dermal contact) with contaminated groundwater that would result in an excess lifetime cancer risk greater than one in a million (1E-06) for individual carcinogens, above 1E-05 for additive carcinogenic contaminants, or above a Hazard Quotient of 1.

The rationale for each of the RAOs and the establishment of cleanup goals is described in the following subsections. The RAOs and cleanup (remediation) goals are summarized in **Table 7-1.**

No RAO or cleanup goal has been developed for protection of ecological receptors because: the baseline risk assessment determined that there were no significant risks to higher tropic level receptors, such as the great blue heron and the red-tailed hawk; small mammals and the plant

community were not receptors of concern at the site because of the likelihood that the site will be redeveloped for industrial or commercial uses; and, projected impacts to fish in downstream creeks were not due to site-related contaminants.

### 7.2.1 Carcinogenic PAHs and PCBs in Soil

The first RAO for protection of human health is to prevent the ingestion of and dermal contact with soil at the site containing carcinogens and noncarcinogens above health-based levels, for current trespassers, future construction workers and future maintenance workers. Although trespass onto Parcel B has been significantly restricted by EPA measures, it has not been totally stopped. Parcel B is vacant and overgrown with vegetation, which allows trespass by transients to occur undetected, particularly in the summer. The current exposure point is surface and subsurface soil on Parcel B.

Parcel B is zoned by Clackamas County for commercial and light industrial use, both currently and for the future. Redevelopment of Parcel B (title currently held by DEQ) is likely to occur in the foreseeable future because it is a significant size (32 acres) of available land, has railroad access, and is situated in close proximity to existing industrial and commercial businesses and parcels of property recently undergoing development. EPA and Oregon DEQ have been contacted by several prospective purchasers in the past few years. Parcel B may have roadways constructed on it in the future, according to Clackamas County and the Oregon Department of Transportation. Consequently, future construction workers and future maintenance workers on Parcel B under the reasonably anticipated future land use could be exposed to surface and subsurface soil contaminants.

Carcinogenic PAHs and total PCBs are the primary human health risk drivers in soil, based on the baseline risk assessment. The remediation goals (RGs) established for the seven individual carcinogenic PAHs (see **Table 7-1**) were calculated based on the exposure scenarios in the baseline risk assessment and a lifetime excess cancer risk of no greater than 1E-6 for individual carcinogens, no greater than 1E-5 for additive carcinogens, or above a Hazard Quotient of 1 for noncarcinogens. The remediation goals for PAHs are driven by ARARs, in particular the Oregon Environmental Cleanup Regulations. Normally, under the NCP, EPA strives to achieve an excess human health cancer risk, for the current or reasonably anticipated future land use, of between $10^{-4}$ and $10^{-6}$. The Oregon Environmental Cleanup Regulations, which are ARARs for the selection of response action, require that the excess cancer risk be no greater than $1 \times 10^{-6}$ for each individual carcinogen, and therefore are more stringent than the NCP.

The remediation goal of 1 mg/kg for total PCBs in soil is ARARs-based. EPA regulations under TSCA at 40 CFR 761.61 provide cleanup and disposal options for PCB remediation waste. The three options include self-implementing, performance-based and risk-based disposal approvals. The risk-based disposal approval option is allowed if it will not pose an unreasonable risk of injury to health and the environment. EPA calculated a risk-based cleanup goal of 1.6 mg/kg for total PCBs, using a similar procedure and based on the same exposure and land use scenarios as that used for individual PAHs, pursuant to Oregon's Environmental Cleanup Regulations. EPA has determined this cleanup goal would not pose an unreasonable risk of injury to human health because it would result in an excess cancer risk of no greater than $1 \times 10^{-6}$. EPA is selecting a slightly lower cleanup goal of 1 mg/kg PCB, rather than 1.6 mg/kg, because it is consistent with PCB cleanup levels at

other Superfund sites in Region 10 and with both the self-implementing and risk-based disposal options of 40 CFR 761.61.

The remediation goals for PAHs and PCBs are applicable to surface and subsurface soil located above the water table, which varies from approximately 4 to 10 feet bgs. Soil below the water table is not expected to be a route of exposure to human health or ecological receptors for the current or reasonably anticipated future land use at the site.

### 7.2.2 Soil to Groundwater Transfer of Chlorinated VOCs

The second RAO for protection of human health is reduction of the potential for PCE, TCE and vinyl chloride sorbed onto soil particles to partition into the groundwater. The RI found 4 plumes of VOC-contaminated groundwater on the site. These plumes likely originated from on-site sources of VOCs in the soil. PCE, TCE and vinyl chloride were shown in the baseline risk assessment to be the primary human health risk drivers in groundwater, using the exposure scenario of a future off-site resident using groundwater for indoor purposes. Groundwater at and in the site vicinity has the potential to be used for drinking water in the future. Therefore, the objective of this RAO is to reduce the potential of VOC-contaminated soil to act as a source for future groundwater contamination, through the establishment of remediation goals for VOCs in soil.

The remediation goals for PCE, TCE and vinyl chloride in soil are ARAR-based, using the Oregon Environmental Cleanup Rules maximum acceptable risk levels. Under the NCP, EPA typically uses Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act regulations as a default point for setting remediation goals for groundwater which could be used for drinking water. MCLs are 5 Fg/l for PCE, 5 Fg/l for TCE and 2 Fg/l for vinyl chloride. Oregon Environmental Cleanup Rules require a maximum excess cancer risk level of $1 \times 10^{-6}$ for individual carcinogens. This results in (risk-based) target groundwater concentrations of 0.9 Fg/l PCE, 1.6 Fg/l TCE and 0.02 Fg/l for vinyl chloride. Since these Oregon ARAR-based target groundwater concentrations are lower than the MCLs, they were used as the basis for developing the remediation goals for PCE, TCE and vinyl chloride in soil. A simple linear equilibrium soil/water partition equation was then used to convert the target groundwater concentrations to respective soil concentrations constituting the RGs.

The remediation goals for PCE, TCE and vinyl chloride in soil are applicable to surface and subsurface soil located above the water table, which varies from approximately 4 to 10 feet bgs.

## 7.3 SUMMARY OF MAIN ARARS DRIVING THE REMEDY

The principal ARARs driving the selection of remedial action at the site include the following:

- Oregon Environmental Cleanup Rules, OAR 340-122
- TSCA Risk-Based Option for PCB Remediation, 40 CFR 761.61

These and other ARARs are discussed in more depth in Section 11.2

## 7.4 DISTRIBUTION AND QUANTITY OF SOIL CONTAMINANTS EXCEEDING REMEDIATION GOALS

### 7.4.1 Parcel A

Limited sampling was performed in Parcel A during the RI due to the existing active businesses. No exceedances of the RGs was detected in surface and subsurface soil in the western lot of Parcel A except for Soil Pile 4 which had exceedances of the RGs for PCBs, benzo(a)pyrene and PCE. There may, however, be an unidentified area of PCE soil contamination in this lot, based on the identification of a plume of PCE-contaminated groundwater that appears to originate in the central portion of this lot. Further investigation of the potential source area of this plume will be conducted by EPA.

In the eastern lot of Parcel A, no exceedances of the RGs were detected in surface and subsurface soil, except for a single location near the middle of the lot which exhibited a minor exceedance for benzo(a)pyrene at 3 feet bgs.

### 7.4.2 Parcel B

Soil sampling in the RI identified widespread occurrence of HPAHs and PCBs in surface and subsurface soil across the 39-acre parcel. Surface soil on almost the entire area of Parcel B exceeds the RGs for at least one COC; and roughly one third of Parcel B has RG exceedances at depth (up to 8 feet bgs). Approximately 103,250 cubic yards (cy) of surface soil (to 2 feet bgs) exceeds the RGs.

Of the chlorinated VOCs, only PCE was detected at concentrations exceeding the RG. Localized elevated concentrations of PCE were found at the southeast corner of plant 3 and at the southeast corner of Parcel B.

Subsurface contamination at depth occurs in seven principal areas as shown in **Table 7-2 and in Figure 8.1**. Approximately 154,500 cy of subsurface soil (below 2 feet bgs) exceeds the RGs.

## 7.5 PRINCIPAL THREAT WASTES

The National Contingency Plan establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practical. Therefore, identifying what materials at a site are considered principal threats is necessary to allow developing and evaluating remedial alternatives.

Both hazard and risk are used to identify principal threat wastes. Generally, principal threat wastes are source materials considered to be highly toxic or highly mobile which generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. The reasonably anticipated land use at a site is used to establish the realistic exposure scenario(s) (e.g.,adult or child residents, industrial workers) and the acceptable risk levels for such exposures. As a rule of thumb, EPA considers as a principal threat those source materials with toxicity and mobility characteristics that combine to pose a potential risk several orders of magnitude greater than the acceptable risk level for the realistic exposure scenarios.

For the Northwest Pipe & Casing site, soil with individual carcinogenic HPAH concentrations 100 or more times greater than the respective RGs constitutes principal threat wastes, based on exposure to trespassers, construction workers and maintenance workers while the site remains vacant and under future industrial and/or commercial uses. Soil with PCB concentrations greater than 160 mg/kg (100 times the RG) is also considered principal threat wastes for these same exposure and land use scenarios.

Soil with concentrations greater than 39 Fg/L of PCE, 40 Fg/L of TCE, or 9 Fg/L of vinyl chloride is also considered principal threat wastes. VOCs in soil at concentrations exceeding these levels may migrate to groundwater at the Northwest Pipe & Casing site, which if used as a source of drinking water by a future off-site resident would exceed the drinking water MCLs and pose an unacceptable health risk.

The estimated quantities of source material constituting principal threat waste at the Northwest Pipe & Casing site are shown below. The estimated quantities take into account that some contaminants are co-located in areas of the site, to avoid double-counting. The quantity of PCB waste shown below includes both principal threat wastes (PCBs greater than 160 mg/kg) and some non-principal threat waste, i.e. PCBs less than 160 mg/kg but greater than 50 mg/kg; the feasibility study estimated PCB waste quantity using 50 mg/kg PCBs as the threshold because the TSCA disposal requirement for soil with PCBs greater than 50 mg/kg is the same as the TSCA disposal requirement for soil with 160 mg/kg or greater PCBs.

- 19,300 cubic yards of soil with excess HPAH levels (includes soil with PCBs less than 50 mg/kg)
- 4,200 cubic yards of soil with PCBs greater than 50 mg/kg
- 9,100 cubic yards of soil with excess PCE, TCE or vinyl chloride levels

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**Table 7-1**
**Summary of Soil RAOs and Remediation Goals**

| RAOs | COC | RG | Source of RG |
|---|---|---|---|
| Prevent exposure of trespassers, future construction and maintenance workers through direct contact (ingestion or dermal contact) with contaminated soil that would result in an excess lifetime cancer risk greater than one in a million (1E-06) for individual carcinogens, above 1E-05 for additive carcinogenic contaminants, or above a Hazard Quotient of 1 | Benzo(a)anthracene | 2,500 Fg/kg | Oregon Environmental Cleanup Rules: risk-based cleanup option, for industrial or commercial land uses |
| | Benzo(b)fluoranthene | 2,500 Fg/kg | |
| | Benzo(k)fluoranthene | 2,500 Fg/kg | |
| | Benzo(a)pyrene | 250 Fg/kg | |
| | Chrysene | 250,000 Fg/kg | |
| | Dibenz(a,h)anthracene | 250 Fg/kg | |
| | Indeno(1,2,3-cd)pyrene | 2,500 Fg/kg | |
| | Total PCBs | 1 mg/kg | Federal PCB Regulations 40 CFR 761.61 and Oregon Environmental Cleanup Rules |
| Prevent migration of soil contaminants to groundwater that would result in exposure to a future off-site resident through direct contact (ingestion, inhalation and dermal contact) with contaminated groundwater that would result in an excess lifetime cancer risk greater than one in a million (1E-06) for individual carcinogens, above 1E-05 for additive carcinogenic contaminants, or above a Hazard Quotient of 1. | Tetrachloroethene | 7 Fg/kg | Calculation using linear equilibrium soil/water partition equation and Oregon Environmental Cleanup Rules risk-based cleanup option |
| | Trichloroethene | 13 Fg/kg | |
| | Vinyl Chloride | 0.1 Fg/kg | |

Notes:
COC - chemical of concern
HQ - hazard quotient
Fg/kg - micrograms per kilogram or parts per billion
mg/kg -milligrams per kilogram or parts per million
RAO - remedial action objective
RG - remediation goal

**Table 7-2**
**Areas of Subsurface Soil Exceeding Remediation Goals**

| Area | Location | Primary COCs | Estimated Volume (CY) |
|---|---|---|---|
| 1 | Burial Area 3 | HPAHs, PCBs, PCE | 18,750 |
| 2 | Burial Area 2 extending south | HPAHs, PCBs, PCE | 15,650 |
| 3 | Northwest corner of Parcel B | HPAHs | 350 |
| 4 | Soil Pile 1 | HPAHs | 1,650 |
| 5 | Burial Area 1, Plants 2-4, Soil Pile 3 | HPAHs, PCBs, PCE | 115,550 |
| 6 | Removed USTs | HPAHs | 400 |
| 7 | Southeast corner of Parcel B | PCBs, PCE | 2,150 |

Notes:
COC - chemical of concern
HPAHs - high molecular weight polycyclic aromatic hydrocarbons
PCBs - polychlorinated biphenyls
PCE - tetrachloroethene
UST - underground storage tank
CY - cubic yards

# 8.0 DESCRIPTION OF SOIL ALTERNATIVES

It is EPA's intent to reduce the risk to humans and the environment to acceptable levels by meeting the RAOs specified in Section 7.2 in the design and implementation of remedial actions.

In the Feasibility Study, technology types and process options were screened to eliminate those technologies/process options that are not technically feasible at the site or that lack demonstrated effectiveness in treating one or more COCs. Some of the remedial technologies/process options screened out include ex-situ biological treatment processes such as landfarming and composting, and ex-situ physical treatment processes such as soil washing and dehalogenation.

Under CERCLA, a no-action alternative must be considered at every site to establish a baseline for comparison with remedial alternatives.

In addition, four remedial alternatives were evaluated for the Northwest Pipe and Casing Company site. Two of the soil alternatives each contain four different treatment and/or disposal process options. These two alternatives were developed to compare different approaches to meeting the maximum allowable excess risk requirement of the Oregon Environmental Cleanup Rules. Thus, a total of ten remedial alternatives/options were evaluated in addition to no-action.

Note: In 2000, EPA will conduct further investigation of soil on the western lot of Parcel A to locate and characterize the suspected source of groundwater contamination Plume 4 arising on the parcel. If this source area investigation identifies contaminated soil with COC concentrations exceeding the RGs, EPA anticipates remediating this soil using the soil remedy selected in this ROD.

The soil alternatives developed for Parcel B include:

- No action, consisting of no measures taken to remediate site soil or prevent human exposure to contaminants.

- Excavating all soil exceeding RGs and either off-site hazardous waste or off-site solid waste landfill disposal, depending on the COC concentrations; and removal or on-site use or disposal of site structures and features, including the aboveground tank containing coal tar, metal bins with refuse, USTs, soil piles 3 and 4, drums of IDW soil and subsurface piping.

- Capping Parcel B with clean topsoil and vegetation; removal of site structures and features including the aboveground tank containing coal tar, metal bins with refuse and USTs; and implementing institutional controls to limit human exposure to soil containing COCs above the RGs.

- Excavating all soil areas meeting the Oregon Environmental Cleanup Rules definition of hot spots and remediating the soil through four treatment and/or disposal options, depending on the COC concentrations; treatment or disposal of soil pile 4 and drums of IDW soil; removal or in-place or on-site management of site structures and features, including the aboveground tank containing coal tar, metal bins with refuse,

subsurface piping and USTs; capping Parcel B; and implementing institutional controls to limit human exposure to soil containing COCs above the RGs.

- Excavating Oregon hot spots plus additional COC-containing soil which exceeds a set of hybrid threshold concentrations for COCs and remediation through four treatment and/or disposal options (resulting in a post-remediation average site-wide risk level meeting the Oregon Environmental Cleanup Rules without requiring a site cap), depending on the COC concentrations; treatment or disposal of soil pile 4 and drums of IDW soil; removal or in-place or on-site management of site structures and features, including the aboveground tank containing coal tar, metal bins with refuse, subsurface piping and USTs.

All quantities of contaminated soil presented in this ROD are estimates based upon data obtained from the site investigations. Additional soil testing will be done during remedial design to verify locations and volumes.

The institutional controls which would be implemented are discussed more fully below under the individual soil alternatives.

## 8.1 Soil Alternative 1--No Action

This alternative consists of allowing the site soil to remain in its present condition, with no measures taken to reduce or monitor COCs in the soil. This alternative is retained throughout the process of alternative development and evaluation, as a baseline for comparison with other alternatives, and to help assure that unnecessary remedial action is not taken where no action is appropriate.

## 8.2 Soil Alternative 2--Excavation and Off-site Disposal

Soil Alternative 2 consists of the following elements, described further in the narrative below:

- removal or on-site use or disposal of site structures and subsurface features
- excavation of all Parcel B soil exceeding the RGs
- disposal of excavated soil in an offsite Subtitle D or Subtitle C landfill
- backfill and revegetate excavations with clean soil
- erosion control actions during implementation to minimize impacts to surface water quality and critical habitat of federally listed threatened or endangered anadromous fish.
- construction of a surface water drainage system for Parcel B, if needed

### *Site Structures and Features*

Site structures and subsurface features, including USTs, the above-ground tank containing solidified coal tar, soil piles 3 and 4, drums of IDW soil, and in-ground piping would be removed and disposed off-site. Soil pile 1, predominantly asphalt, would be reused or buried on-site. Soil pile 2 would be used on-site as backfill. Other site features would be managed as shown in **Table 8-1.**

***Soil Excavation***

Soil exceeding the COC RGs (presented in Table 7-1) would be excavated. The maximum depth of excavation would be the water table, or approximately 9 feet bgs. A total of 257,750 cubic yards (cy) of soil would be excavated, including 103,250 cubic yards from the top two feet and 154,500 cubic yards from the deeper contaminated areas **(**see **Figure 8-1)**.

***Off-site Disposal***

Excavated soil would be transported to either a TSCA or RCRA Subtitle D landfill, based upon the concentrations of COCs in the soil. Approximately 253,500 cy could be disposed at a RCRA Subtitle D landfill; 4,250 cy would require TSCA landfill disposal due to the levels of PCBs. Approximately 120 cubic yards of soil would be treated on-site by vapor extraction prior to off-site disposal, because the soil may fail the RCRA Toxicity Characteristic Leaching Procedure (TCLP) for PCE.

***Backfill and Revegetation***

Excavated areas would be filled with imported clean soil and then hydroseeded to establish a vegetative cover.

***Erosion Control***

Erosion control actions would be taken during implementation to minimize impacts to surface water quality and critical habitat of federally listed threatened or endangered anadromous fish.
A surface water drainage system for Parcel B would be constructed, if needed.

***Time to Implement***

This alternative is estimated to require approximately 3-4 years to complete.

## 8.3 Soil Alternative 3--Capping

Soil Alternative 3 consists of the following elements, described further in the narrative below:

- removal of site structures and subsurface features which may interfere with cap placement
- capping Parcel B with two feet of clean soil and revegetation
- construction of a surface water drainage system for Parcel B, if needed
- monitoring and maintenance of the cap
- institutional controls

***Site Structures and Features***

Soil piles 1,2, 3 and 4 and drums of IDW soil would be graded flat over Parcel B prior to capping. Subsurface piping would be left in-place. The aboveground tank containing coal tar, metal bins with

refuse and USTs would be removed. All other site features would be managed in the same manner as Soil Alternative 2 (see **Table 8-1**).

***Capping and Revegetation***

The entire 32-acre Parcel B would be capped with 2 feet of clean topsoil and revegetated to limit human exposure to the underlying soil contaminants. Although small areas of surface soil scattered throughout the site already meet the RGs, the cap would cover these areas to increase implementability and ease of maintenance. Capping would require 103,000 cubic yards of imported soil (see **Figure 8-2**).

***Erosion Control***

A surface water drainage system for Parcel B would be constructed, if needed.

***Monitoring and Maintenance***

Periodic inspections and necessary maintenance of the cap would be performed to ensure the long-term integrity of the cover is preserved.

***Institutional Controls***

Institutional controls would be implemented to limit and manage human exposure to contaminated soil underneath the cap. Institutional controls are defined as legal mechanisms that ensure that restrictions on land use and any engineering controls put in place to implement the selected remedy are maintained over time. Since this alternative would result in COC levels on Parcel B that do not allow for unlimited and unrestricted exposure throughout the site, institutional controls would be implemented to limit intrusive activities into the underlying soil and to warn of the subsurface soil contaminant hazards. The Oregon DEQ owns fee simple title to Parcel B; therefore, EPA expects to be able to obtain institutional controls without problem. The identified institutional controls for Parcel B include deed restrictions which run with the land and a deed notice. Future development or reuse of Parcel B would be limited through institutional controls to those uses which would not compromise the protectiveness of the soil cap. The use restrictions will be binding on subsequent owners of Parcel B.

***Time to Implement***

Approximately one year would be required to implement this alternative.

## 8.4 Soil Alternatives 4A through 4D--Oregon Hot Spots Soil Excavation

The four S4 alternatives (S4A, S4B, S4C and S4D) consist of excavating soil meeting the Oregon Environmental Cleanup Rules' definition of hot spots, and then applying one of several different treatment and disposal methods to the excavated soil. Because removing hot spots of soil contamination would not by itself achieve the maximum acceptable risk levels of the Oregon

Environmental Cleanup Rules, the S4 alternatives include a soil cap and institutional controls to further reduce post-remediation risk levels to meet ARARs.

All S4 alternatives have the following common elements, described further in the narrative below:

- removal or in-place or on-site management of site structures and features
- excavation of Parcel B soil exceeding the Oregon Hot Spot definition
- soil treatment or disposal methods, specific to the alternative
- backfilling excavations
- erosion control actions during implementation to minimize impacts to surface water quality and critical habitat of federally listed threatened or endangered anadromous fish.
- security patrols on Parcel B until the cap is completed
- capping Parcel B with two feet of clean soil and revegetation
- construction of a surface water drainage system for Parcel B, if needed
- monitoring and maintenance of the cap
- institutional controls

Following the discussion of common elements, the individual S4 alternatives are presented.

***Site Structures and Features***

Site structures and subsurface features would be managed similarly to Soil Alternative 2, except that soil pile3 would be graded flat or used as backfill and soil pile 4 and the drums of IDW soil would be treated or disposed per the alternative option (see **Table 8-1**).

***Soil Excavation***

Soil exceeding COC concentrations based on the Oregon Hot Spot definition under the Oregon Environmental Cleanup Rules would be excavated, to a maximum depth of the water table or approximately 9 feet bgs. A total of 32,600 cubic yards would be excavated and removed.

***Oregon Hot Spots***

The State of Oregon Environmental Cleanup Rules are ARARs pertaining to remedial actions for the site. These rules provide that, for media other than groundwater and surface water (e.g., contaminated soil, debris, sludges, etc.), if hazardous substances present a risk to human health or the environment exceeding the acceptable risk level, the extent to which the hazardous substances are "highly concentrated", "highly mobile" or "not reliably containable" is defined as "hot spots" of contamination. These rules provide for establishing threshold concentrations for COCs on a site-specific basis, to be used to determine if soil meets any of these three criteria and therefore should be classified as a hot spot.

*Highly concentrated* hot spots were identified as all soil areas in which the individual COC concentration exceeded the human exposure risk-based RG by more than 100 times. For PCBs, a hot spot threshold of 20 mg/kg, rather than 160 mg/kg, (100 times the risk-based RG of 1.6 mg/kg) was

considered appropriate, based on the federal TSCA PCB regulations at 40 CFR 761.61(c) which are also ARARs. Under the risk-based approach to PCB remediation waste management allowed by 40 CFR 761.61(c) , EPA believes that PCBs levels greater than 20 mg/kg should not be left on site without further engineering controls to limit exposure. Hence, a PCB hot spot threshold of 20 mg/kg was selected. The total volume of *highly concentrated* hot spot soil is 23,500 cubic yards.

*Highly mobile* hot spots were identified as all soil areas in which COCs could migrate to groundwater and result in groundwater concentrations in excess of Federal Drinking Water Regulations maximum contaminant levels (MCLs). Mobility of the HPAHs and PCBs is not significant due to their low solubility and strong adsorption to soil, as confirmed by the RI. However, PCE, TCE and vinyl chloride typically are quite mobile in the environment and can migrate from soil to groundwater. The RI confirmed the presence of 4 plumes of VOC-contaminated groundwater on-site. A simple linear equilibrium soil/water partition equation and the MCLs for PCE, TCE and vinyl chloride were used to develop soil threshold levels for these three COCs. The total volume of *highly mobile* hot spot soil is 9,100 cubic yards.

*Not reliably containable* hot spots are areas which could be prone to flooding, landslides, vandalism or otherwise difficult to contain contaminants from migrating. No additional areas of the Northwest Pipe and Casing Company site beyond those identified as highly concentrated and highly mobile were identified as being not reliably containable.

A summary of the COC concentrations developed to delineate areas of Oregon hot spots in soil at the Northwest Pipe and Casing Company site is presented in **Table 8-2**. Seven distinct areas of Parcel B exceed one or more of the hot spot threshold concentrations (see **Figure 8-3**). These areas are generally shallow (<4 feet), with two deeper locations near groundwater contaminant plume sources. The hot spots are primarily located near Plants 2 and 3 and Burial areas 1 and 2. The total volume of Oregon Hot Spot soil is 32,600 cubic yards.

***Relation of Oregon Hot Spots to Principal Threat Wastes***

The National Contingency Plan establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practical. Therefore, identifying what materials at a site are considered principal threats is necessary to allow developing and evaluating remedial alternatives. As a rule of thumb, EPA considers as a principal threat those source materials with toxicity and mobility characteristics that combine to pose a potential risk several orders of magnitude greater than the acceptable risk level for the realistic exposure scenarios.

Principal threat wastes for the site were identified and discussed in Section 7.5, including an estimation of quantities. Oregon Hot Spots encompass all of the principal threat waste, plus additional non-principal threat waste consisting of soil with PCB concentrations less than 160 mg/kg but greater than 20 mg/kg.

Alternative S4A would not treat any principal threat waste. Alternative S4B, on-site thermal desorption, would treat all of the principal threat waste at the site. Under alternative S4C, all of the principal threat waste would be treated, either by an off-site thermal treatment facility or incinerator.

Under alternative S4D, most of the principal threat waste would be treated by an off-site thermal treatment facility, but some PCB-contaminated soil (greater than 50 mg/kg) would be land disposed without treatment.

***Soil Treatment or Disposal Options***

Each of the four S4 alternatives includes a specific method for either treating or disposing of the excavated soil. These treatment or disposal methods are discussed under the individual alternatives. The options considered included off-site landfilling, on-site and off-site thermal treatment, and incineration.

***Backfill***

Excavated areas would be backfilled with either clean or treated soil, depending on the treatment/disposal option., and graded flat to match existing land contours. Approximately 32,600 cubic yards of fill material would be needed.

***Security Patrols***

Security patrols would be conducted periodically on Parcel B, until the cap is completed, to deter trespass onto the site.

***Capping and Revegetation***

Because removing hot spots of soil contamination would not by itself achieve the maximum acceptable risk levels of the Oregon Environmental Cleanup Rules, the S4 alternatives include additional engineering and institutional controls to further reduce post-remediation risk levels to meet ARARs. The engineering controls consist of a cap placed on Parcel B after removal of hot spots soil. Capping would require 103,000 cubic yards of imported soil. Although small areas of surface soil scattered throughout the site already meet the RGs, the cap would cover these areas to increase implementability and ease of maintenance. The cap would be hydroseeded to reestablish vegetation.

***Erosion Control***

Erosion control actions would be taken during implementation to minimize impacts to surface water quality and critical habitat of federally listed threatened or endangered anadromous fish.
A surface water drainage system for Parcel B would be constructed, if needed.

***Cap Monitoring and Maintenance***

Periodic inspections and necessary maintenance of the cap would be performed to ensure the long-term integrity of the cover is preserved.

***Institutional Controls***

Since the S4 alternatives would result in COC levels on Parcel B that do not allow for unlimited and unrestricted exposure throughout the site, institutional controls would be implemented to limit intrusive activities into the underlying soil and to warn of the subsurface soil contaminant hazards. Institutional controls would consist of the same measures as discussed under Soil Alternative 3.

### 8.4.1 Soil Alternative 4A--Oregon Hot Spots Excavation and Off-site Disposal

This alternative consists of the common elements identified above, and the additional following elements, described further in the narrative below:

- disposal of excavated Oregon Hot Spot soil in an off-site landfill
- backfilling excavations with clean soil

***Off-site Soil Disposal***

Excavated soil would be transported to either a TSCA-compliant RCRA Subtitle C landfill or a RCRA Subtitle D landfill, based upon the concentrations of COCs in the soil. Approximately 4,250 cy would be disposed in a TSCA-compliant landfill because the PCBs level is greater than 50 mg/kg. Approximately 28,350 cy of soil would be disposed at a RCRA Subtitle D landfill because it neither is RCRA hazardous waste nor has PCBs greater than 50 mg/kg.

An estimated 120 cubic yards of soil from the vicinity of Plant 3 may exhibit the RCRA TCLP characteristic for PCE. An additional presently-unknown quantity of PCE-contaminated soil from other areas on Parcel B may be determined to be RCRA TCLP following further soil sampling during remedial design. These quantities of soil would be treated in an on-site Area of Contamination (AOC) until the soil no longer exhibits the TCLP characteristic, prior to off-site disposal. The AOC would be established in this ROD for VOC-contaminated soil and would encompass Parcel B. Pursuant to EPA policy, because an AOC is equated to a RCRA land-based unit, consolidation and *in situ* treatment of hazardous waste within the AOC do not create a new point of hazardous waste generation for purposes of RCRA. Therefore, soil within the AOC may be consolidated or treated *in-situ* without triggering RCRA land disposal restrictions (LDRs) or minimum technology requirements.

***Backfill***

Excavated areas would be filled with clean imported soil. Backfilling would require 32,600 cubic yards of clean soil.

***Time to Implement***

This alternative would require approximately 1 to 2 years to carry out.

### 8.4.2 Soil Alternative 4B--Oregon Hot Spots Excavation and On-site Thermal Desorption

Soil Alternative 4B consists of the common elements identified above, and the additional following elements, described further in the narrative below:

- excavated soil would be treated in an on-site mobile thermal desorber
- treated soil would be used to backfill excavations on-site

***On-site Soil Thermal Desorption***

Excavated soil would be treated on-site (Parcel B) using a mobile thermal desorber. This treatment involves the application of heat, either directly or indirectly, to the soil in an enclosed unit to drive off the contaminants from the soil. Volatized or oxidized contaminants are then conveyed to a gas treatment system for removal. The mobile thermal desorber would be removed from the site following soil treatment.

Prior to full-scale operation, the mobile thermal desorber requires a proof of performance test. This test is site-specific and would require the thermal desorber to be on-site. Results of the on-site test may necessitate modification of this alternative to include another form of treatment or disposal for soils with high PCB concentrations. The thermal desorber would be required to treat the soil to achieve residual levels of all COCs less than the respective remediation goals. The total volume of Oregon Hot Spot soil which would be treated on-site is 32,600 cubic yards.

***Backfill***

Excavated areas would be filled with thermally treated soil. Backfilling would require 32,600 cubic yards of treated soil.

***Time to Implement***

This alternative would require approximately 1 to 3 years to carry out.

### 8.4.3 Soil Alternative 4C--Oregon Hot Spots Excavation and Off-site Thermal Desorption and Incineration of Soils Exceeding Desorber Limits

Soil Alternative 4C consists of the common elements identified above, and the additional following elements, described further in the narrative below:

- excavated soil would be treated in an off-site thermal desorber facility
- soil exceeding the thermal desorber treatment permit limits would be incinerated
- thermally treated soil meeting criteria established in this ROD would be returned to the site for use as backfill for excavations

### *Off-site Soil Thermal Desorption*

Excavated soil would be transported to an off-site thermal desorption facility or an incinerator for treatment, depending upon the COC concentrations. Soil with PCBs greater than 50 mg/kg or that exhibits the RCRA TCLP characteristic for PCE would be transported to an off-site TSCA-compliant incinerator for treatment because the thermal desorber is not permitted to treat soil exceeding these levels or which is RCRA hazardous waste. Soil with individual HPAH concentrations greater than the hot spot levels, PCB concentrations less than 50 mg/kg PCB and which does not fail the RCRA TCLP for PCE would be transported to an off-site thermal desorber for treatment. The total volume of Oregon Hot Spot soil is 32,600 cubic yards. Of this amount, approximately 4,050 cubic yards of soil would be treated in an incinerator.

A treatability study using soil from Parcel B was performed in May 1999 at the TPS Technologies Incorporated (TPS) thermal treatment facility located in Portland, Oregon to confirm the effectiveness of a thermal desorber to treat the COCs in soil. The TPS thermal desorber is a direct-fired rotary dryer unit manufactured by Tarmac. For highly contaminated soil, the typical soil exit temperature is 800 to 850 $^{o}$F and the typical residence time is 8 to10 minutes. Prior to treatment, soil is sorted with a 2.5-inch screen. The off-gas treatment system consists of a secondary combustion chamber where organics are thermally oxidized at 1450 $^{o}$F.

The performance criteria established by EPA for the thermal desorber treatability test were the RGs established for soil COCs at the Northwest Pipe and Casing Company site, as presented in **Table 7-1**, since the soil was intended to be returned to the site (and used as backfill). Therefore, performance of the TPS desorber was assessed based on reduction of the site-specific COCs as compared to the respective RGs. The treatability study used two test soils from the site, chosen to reflect a worst-case scenario of relatively high HPAH concentrations and PCB levels that were relatively high but less than the facility's acceptance criteria of 50 mg/kg. Also, since finer-grained soil such as silts and sands is more difficult to treat via thermal desorption than coarser material, site locations that were predominantly sandy or silty were chosen.

The treatability tests demonstrated that soil from the Northwest Pipe and Casing Company site could be successful treated by thermal desorption. The post-treatment concentrations of all individual HPAHs and total PCBs were well below their respective RGs for both test soils. Removal efficiencies were 98.5 to 99.7 percent for individual HPAHs and 98.4 to 99.3 percent for Total PCBs. The results of the treatability test for test soil 1 are summarized in **Table 8-4**. Samples were not collected for VOC analysis. Given the proven nature of thermal desorption treatment for VOCs and the desorber operating temperature of 800 to 850 $^{o}$F, it is unlikely that detectable VOCs concentrations remained upon completion of treatment.

### *Backfill*

Backfilling would require a total of 32,600 cubic yards of treated soil. The thermally treated soil would be returned to the site for use as backfill, supplemented by 4,050 cubic yards of clean soil, to replace the contaminated soil sent to the incinerator. Incinerated soil would not be returned to the site.

***Time to Implement***

Approximately 1 to 2 years would be required to implement this alternative.

### 8.4.4 Soil Alternative 4D--Oregon Hot Spots Excavation and Off-site Thermal Desorption and Landfill Disposal of Soils Exceeding Desorber Limits

Soil Alternative 4D consists of the common elements identified above, and the additional following elements, described further in the narrative below:

- excavated soil would be treated in an off-site thermal desorber facility
- soil exceeding the thermal desorber treatment permit limits would be landfilled off-site
- thermally treated soil meeting criteria established in this ROD would be returned to the site for use as backfill for excavations

***Off-site Soil Thermal Desorption***

Excavated soil would be transported to an off-site thermal desorption facility for treatment or an off-site landfill for disposal, depending on the COC concentrations. Soil with greater than 50 mg/kg PCB or which exhibits the RCRA TCLP characteristic for PCE would be transported to an off-site TSCA-compliant RCRA Subtitle C landfill for disposal because the thermal desorber is not permitted to treat soil exceeding these levels or which is RCRA hazardous waste. Soil with individual HPAH concentrations greater than the hot spot levels, PCB concentrations less than 50 mg/kg, and which does not fail the RCRA TCLP characteristic for PCE would be transported to an off-site thermal desorber for treatment. The total volume of Oregon Hot Spot soil is 32,600 cubic yards. Of this amount, approximately 4,050 cubic yards of soil would require Subtitle C landfill disposal.

An estimated 120 cubic yards of soil exhibiting the RCRA TCLP characteristic for PCE would be treated in an on-site Area of Contamination (AOC) until it no longer exhibits the TCLP characteristic, prior to off-site disposal. Designation of an AOC for the soil would proceed in similar fashion to the AOC described under Alternative S4A.

As discussed for Soil Alternative S4C above, a treatability study on soil from the site demonstrated the effectiveness of an off-site thermal desorber to treat the COCs in soil to below the respective RGs.

***Backfill***

Backfilling the soil excavations would require a total of 32,600 cubic yards of material. Thermally treated soil would be returned to the site for use as backfill, supplemented by 4,050 cubic yards of clean soil, to replace the contaminated soil sent to the landfill.

***Time to Implement***

Approximately 1 to 2 years would be required to implement this alternative.

## 8.5 Soil Alternatives 5A through 5D--Hybrid Thresholds Soil Excavation

The four S5 alternatives (S5A, S5B, S5C and S5D) consist of excavating Oregon hot spot soil plus additional soil that exceeds a set of hybrid threshold concentrations for COCs, and then applying one of several different treatment and disposal methods to the excavated soil. By removing more contaminated soil beyond hot spots, the S5 alternatives would achieve a post-remediation average site-wide risk lower than the maximum acceptable risk levels of the Oregon Environmental Cleanup Rules. Therefore, the S5 alternatives do not need any further engineering controls such as a soil cap to further reduce post-remediation risk levels to meet ARARs.

All S5 alternatives have the following common elements, as described further in the narrative below:

- removal or in-place or on-site management of site structures and subsurface features
- excavation of Parcel B soil exceeding the hybrid thresholds for COCs
- soil treatment or disposal methods specific to the alternative
- backfilling excavations
- erosion control actions during implementation to minimize impacts to surface water quality and critical habitat of federally listed threatened or endangered anadromous fish
- construction of a surface water drainage system for Parcel B, if needed
- institutional controls

Following the discussion of common elements, the individual S5 alternatives are presented.

***Site Structures and Features***

Site structures and subsurface features would be managed identically to Soil Alternatives 4A-4D (see **Table 8-1**).

***Soil Excavation***

Soil exceeding the hybrid threshold concentrations would be excavated. The maximum depth of excavation would be to the water table, approximately a depth of 9 feet bgs. There would be 15 separate excavation areas located throughout the site. A total of 69,850 cubic yards would be excavated.

***Hybrid Thresholds***

This subsection describes the process used to develop the S5 alternatives and explains the basis for selecting COC action levels and why they are referred to “hybrid thresholds”.

As discussed earlier, the Oregon Environmental Cleanup Rules are ARARs and therefore a principal consideration for selecting remediation goals and response action at the site. These state rules establish the following maximum acceptable risk levels:

- 1.0E-6 for individual carcinogens
- 1.0E-5 for multiple carcinogens, and
- a Hazard Index of 1.0 for noncarcinogens

The S5 Soil Alternatives were developed to offer another option, beyond those already presented, for achieving these maximum acceptable risk levels. In particular, the underlying concept is that if even more contaminated soil than the hot spots is excavated and remediated, the post-remediation site-wide risk of the site soil, calculated based on the COC concentrations in the remaining untreated soil and in the treated soil backfilled, will be lower than the state's maximum acceptable risk levels and therefore no additional engineering controls, such as a soil cap, would be needed to meet ARARs. Hence, the S5 Soil Alternatives represent a tradeoff where more soil is remediated (increasing remedy costs) to eliminate the need for a cap (decreasing remedy costs).

In order to determine how much more soil beyond hot spots would need to be excavated and remediated, the following risk-based approach, was used. First, the main human health cancer risk driver (i.e., most toxic and widespread) of the soil COCs was determined. The baseline human health risk assessment determined that carcinogenic PAHs were the main cancer risk drivers for exposure to soil, and that of these PAHs benzo(a)pyrene accounted for the majority of the risk. For example, for the future on-site maintenance worker exposed under RME to soil COCs through direct contact, benzo(a)pyrene accounted for approximately 50 percent of the excess cancer risk posed by all of the carcinogenic PAHs and the excess cancer risk due to benzo(a)pyrene was an order of magnitude higher than the excess cancer risks due to the other carcinogenic PAHs.

The second step was to set a maximum soil concentration or "threshold" for benzo(a)pyrene. The benzo(a)pyrene remediation goal of 1,600 Fg/kg (as shown in Table 7-1) was selected because it represents an excess cancer risk of 1.0E-6 for the reasonably likely future land use and exposure scenarios at the site. Maximum concentrations for the other individual PAHs were not considered necessary, because the high concentrations of individual carcinogenic PAH compounds are generally co-located at the site and the excavation of soil exceeding the benzo(a)pyrene threshold likely would result in acceptable residual site risk (i.e., less than 1.0E-06) for all of the other carcinogenic PAHs.

The next step was to add a threshold for total HPAHs, to enable use of a significant quantity of total HPAHs field data from the RI. The total HPAHs field method does not give concentrations of the individual HPAHs. However, when combined with a specific threshold for benzo(a)pyrene, the main PAH risk driver, a total HPAH threshold enhances the ability to define areas of soil which contribute to the majority of human risk. Because no risk-based threshold exists for total HPAHs, a threshold concentration was developed using the relationship between soil volume excavated and HPAH concentrations of soil removed. The total HPAHs threshold concentration of 200 mg/kg represents the optimal point where the most contaminant mass is removed while minimizing the soil volume excavated.

The last step was to ensure that Oregon Hot Spots would be excavated. Therefore, the PCB threshold of 20 mg/kg and the PCE, TCE and vinyl chloride thresholds of 39 Fg/kg, 40 Fg/kg and 9 Fg/kg respectively, from the Oregon Hot Spots delineation were retained.

The set of combined COC hybrid thresholds developed as described above is presented in **Table 8-3**. Since several approaches were used to develop this set of COC thresholds, the S5 Alternatives are referred to as "hybrid threshold" alternatives.

The S5 Soil Alternatives would remediate all areas of soil above the water table in which concentrations of COCs exceed the hybrid thresholds. **Figure 8-4** shows the locations of the hybrid threshold areas. The hybrid threshold alternatives S5A through S5D involve the excavation of a total 69,850 cubic yards of soil, which is 37,250 cubic yards more contaminated soil than the Oregon Hot Spot Alternatives S4A through S4D.

The S5 alternatives, by removing significantly more contaminated soil than the S4 alternatives, are able to achieve maximum acceptable risk levels of the Oregon ARARs and therefore do not need additional engineering controls, such as a cap, for risk reduction.

***Relation of Hybrid Threshold Soil to Principal Threat Wastes***

The National Contingency Plan establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practical. Principal threat wastes for the site were identified and discussed in Section 7.5, including an estimation of quantities. The areas and quantities of soil defined by the hybrid thresholds encompass all of the principal threat waste, plus significant additional amount of non-principal threat waste consisting of soil with PCB concentrations less than 160 mg/kg but greater than 20 mg/kg, and soil with HPAH concentrations of less than 100 times greater than the RGs.

Alternative S5A would not treat any principal threat waste. Alternative S5B, on-site thermal desorption, would treat all of the principal threat waste at the site. Under alternative S5C, all of the principal threat waste would be treated, either by an off-site thermal treatment facility or incinerator. Under alternative S5D, most of the principal threat waste would be treated by an off-site thermal treatment facility, but some PCB-contaminated soil (greater than 50 mg/kg) would be land disposed without treatment.

***Soil Treatment or Disposal Options***

Each of the four S5 alternatives includes a specific method for either treating or disposing of the excavated soil. These methods are discussed under the individual alternatives.

***Backfill***

Excavated areas would be backfilled with either clean or treated soil, depending on the treatment/disposal option., and graded flat to match existing land contours. Approximately 69,850 cubic yards of fill material would be needed.

***Erosion Control***

Erosion control actions would be taken during implementation to minimize impacts to surface water quality and critical habitat of federally listed threatened or endangered anadromous fish.
A surface water drainage system for Parcel B would be constructed, if needed.

### 8.5.1 Soil Alternative 5A--Hybrid Areas Excavation and Off-site Disposal

This alternative consists of the common elements identified above, and the additional following elements, described further in the narrative below:

- disposal of excavated soil from hybrid threshold areas in an off-site landfill
- backfilling excavations with clean soil

***Off-site Soil Disposal***

Excavated soil would be transported to either a TSCA-compliant RCRA Subtitle C or RCRA Subtitle D landfill, based upon the concentrations of COCs in the soil. Approximately 4,250 cubic yards of soil would be disposed at a TSCA-compliant RCRA Subtitle C landfill because the levels of PCBs are greater than 50 mg/kg. The remaining soil (65,600 cubic yards) could be disposed at a RCRA Subtitle D solid waste landfill because it would not be classified as RCRA hazardous waste.

An estimated 120 cubic yards of soil exhibiting the RCRA TCLP characteristic for PCE would be treated in an on-site Area of Contamination (AOC) until it no longer exhibits the TCLP characteristic, prior to off-site disposal. The AOC would be identical to that described in Alternative S4A.

***Backfill***

Excavated areas would be filled with clean soil. Backfilling would require 69,850 cubic yards of clean soil.

***Time to Implement***

This alternative would require approximately 1-2 years to complete.

### 8.5.2 Soil Alternative 5B--Hybrid Areas Soil Excavation and On-site Thermal Desorption

Soil Alternative 5B consists of the common elements identified above, and the additional following elements, described further in the narrative below:

- excavated soil would be treated in an on-site mobile thermal desorber
- treated soil would be used to backfill excavations

### *On-site Soil Thermal Desorption*

Excavated soil would be treated on-site (Parcel B) using a mobile thermal desorber. This treatment involves the application of heat, either directly or indirectly, to the soil in an enclosed unit to drive off the contaminants from the soil. Volatized or oxidized contaminants are then conveyed to a gas treatment system for removal. The mobile thermal desorber would be removed from the site following soil treatment.

Prior to full-scale operation, the mobile thermal desorber requires a proof of performance test. This test is site-specific and would require the thermal desorber to be on-site. Results of the on-site test may necessitate modification of this alternative to include another form of treatment or disposal for soils with high PCB concentrations. The thermal desorber would be required to treat the soil to achieve residual levels of COCs less than the respective remediation goals. An estimated 69,850 cubic yards of soil would be treated on-site.

### *Backfill*

Excavated areas would be filled with thermally treated soil. Backfilling would require 69,850 cubic yards of treated soil.

### *Time to Implement*

This alternative would require approximately 1 to 3 years to complete.

## 8.5.3 Soil Alternative 5C--Hybrid Areas Soil Excavation and Off-site Thermal Desorption and Incineration of Soils Exceeding Desorber Limits

Soil Alternative 5C consists of the common elements identified above, and the additional following elements, described further in the narrative below:

- excavated soil would be treated in an off-site thermal desorber facility
- soil exceeding the thermal desorber treatment permit limits would be incinerated
- thermally treated soil which met criteria established in the ROD would be returned to the site for use as backfill for excavations

### *Off-site Soil Thermal Desorption*

Excavated soil would be transported to an off-site thermal desorption facility or an incinerator for treatment, depending upon the COC concentrations. Soil with PCBs greater than 50 mg/kg or that exhibits the RCRA TCLP characteristic for PCE would be transported to an off-site TSCA-compliant incinerator for treatment because the thermal desorber is not permitted to treat soil exceeding these levels or which is RCRA hazardous waste. Soil with HPAH concentrations greater than the hybrid threshold levels, PCB concentrations less than 50 mg/kg PCB and which is not RCRA TCLP characteristic for PCE would be transported to an off-site thermal desorber for

treatment. The total volume of soil sent off-site for treatment and incineration is 69,850 cubic yards. Of this amount, approximately 4,050 cubic yards of soil would be treated in an incinerator.

As discussed in Section 8.4., a treatability study using soil from Parcel B was performed in May 1999 at the TPS Technologies Incorporated (TPS) thermal desorber facility located in Portland, Oregon. The treatability tests demonstrated that soil from the Northwest Pipe and Casing Company site could be successful treated by thermal desorption. The post-treatment concentrations of all individual HPAHs and total PCBs were well below their respective RGs for both test soils. The results of the treatability test for test soil 1 are summarized in **Table 8-4**. Samples were not collected for VOC analysis. Given the proven nature of thermal desorption treatment for VOCs and the desorber operating temperature of 800 to 850 $^{o}$F, it is unlikely that detectable VOCs concentrations remained upon completion of treatment.

***Backfill***

Soil treated by thermal desorption would be returned to the site and used to backfill the excavations, supplemented by approximately 4,050 cubic yards of imported clean fill.

***Time to Implement***

This alternative would require approximately 1 to 2 years to complete.

### 8.5.4 Soil Alternative 5D--Hybrid Areas Soil Excavation and Off-site Thermal Desorption and Landfill Disposal of Soils Exceeding Desorber Limits

Soil Alternative 5D consists of the common elements identified above, and the additional following elements described further in the narrative below::

- excavated soil would be treated in an off-site thermal desorber facility
- soil exceeding the thermal desorber treatment permit limits would be landfilled offsite
- thermally treated soil which met criteria established in the ROD would be returned to the site for use as backfill

***Off-site Soil Thermal Desorption***

Excavated soil would be transported to an off-site thermal desorption facility for treatment or an off-site landfill for disposal, depending on the COC concentrations. Soil with greater than 50 mg/kg PCB or which exhibits the RCRA TCLP characteristic for PCE would be transported to an off-site TSCA-compliant RCRA Subtitle C landfill for disposal because the thermal desorber is not permitted to treat soil exceeding these levels or which is RCRA hazardous waste. Soil with HPAH concentrations greater than the hybrid threshold levels, PCB concentrations less than 50 mg/kg, and which is not RCRA TCLP characteristic for PCE would be transported to an off-site thermal desorber for treatment. The total volume of soil is 69,850 cubic yards. Of this amount, approximately 4,050 cubic yards of soil would require Subtitle C landfill disposal.

An estimated 120 cubic yards of soil exhibiting the RCRA TCLP characteristic for PCE would be treated in an on-site Area of Contamination (AOC) until it no longer exhibits the TCLP characteristic, prior to off-site disposal. The AOC would be identical to that described in Alternative S4A.

As discussed in Section 8.5.3 above, a treatability study on soil from the site demonstrated the effectiveness of an off-site thermal desorber to treat the COCs in soil to below the respective RGs.

***Backfill***

Soil treated by thermal desorption would be returned to the site and used to backfill the excavations, supplemented by approximately 4,050 cubic yards of imported clean fill.

***Time to Implement***

This alternative would require approximately 1 to 2 years to complete.

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## Table 8-1
## Remedial Actions for Site Features

| Parcel | Site features | Alt. S2 --Excavation and Off-site Disposal | Alt S3 – Capping | Alt S4 -- Oregon Hot Spots | Alt S5 -- Hybrid |
|---|---|---|---|---|---|
| A | Soil Pile 4 | Remove and dispose off-site. | Grade flat over Parcel B prior to cap. | Treat or dispose per alternative options. | Same as Alt S4. |
| | 2 Vertical Drains | Leave as is. | Same as Alt S2. | Same as Alt S2. | Same as Alt S2. |
| | Industrial well | Leave as is. | Same as Alt S2. | Same as Alt S2 | Same as Alt S2. |
| B | Soil and Debris Pile 2 | Use as backfill. | Grade flat over Parcel B prior to cap. | Use as backfill or grade flat. | Same as Alt S4. |
| | Soil and Debris Pile 3 | Remove and dispose off-site | Grade flat over Parcel B prior to cap. | Use as backfill or grade flat. | Same as Alt S4. |
| | Pile 1 (predominantly asphalt) | Bury on-site. | Same as Alt S2. | Same as Alt S2. | Same as Alt S2. |
| | Aboveground Tank with Coal Tar | Dispose off-site. | Same as Alt S2. | Same as Alt S2. | Same as Alt S2. |
| | Metal Bins with Refuse | Dispose off-site. | Same as Alt S2. | Same as Alt S2. | Same as Alt S2. |
| | USTs (potentially 3) | Remove and dispose off-site. | Same as Alt S2. | Same as Alt S2. | Same as Alt S2. |
| | Concrete Pad/foundation | Break into smaller pieces and bury on-site. | Same as Alt S2. | Same as Alt S2. | Same as Alt S2. |
| | Stockpiled Concrete Debris | Break into smaller pieces and bury on-site | Same as Alt S2. | Same as Alt S2. | Same as Alt S2. |
| | In-Ground Structure | Excavate around structure, empty if needed, and abandon in-place or remove and dispose off-site. | Same as Alt S2. | Same as Alt S2. | Same as Alt S2. |
| | 4 Drains/outfalls | Remove portions in excavated area and dispose off-site. Plug remaining portions. | Plug and leave in place. | Same as Alt S2. | Same as Alt S2. |
| | Subsurface Piping | Remove portions in excavated area and dispose off-site. Plug remaining portions. | Leave as is. | Same as Alt S2. | Same as Alt S2. |
| | Drainage Ditch Improvement | Evaluate and improve as necessary | Same as Alt S2. | Same as Alt S2. | Same as Alt S2. |
| | Railroad Ties and Rails | Recycle or dispose off-site | Same as Alt S2. | Same as Alt S2. | Same as Alt S2. |
| | Drums of IDW soil | Dispose off-site | Grade flat over Parcel B prior to cap. | Treat or dispose per alternative options. | Same as Alt S4. |

**Table 8-2**
**Oregon Hot Spot Soil Concentrations**

| COC | Concentration (Fg/kg) |
|---|---|
| Benzo(a)anthracene | 250,000 |
| Benzo(b)fluoranthene | 250,000 |
| Benzo(k)fluoranthene | 250,000 |
| Benzo(a)pyrene | 25,000 |
| Chrysene | 25,000,000 |
| Dibenz(a,h)anthracene | 25,000 |
| Indeno(1,2,3-cd)pyrene | 250,000 |
| Tetrachloroethene (PCE) | 39 |
| Trichloroethene (TCE) | 40 |
| Vinyl Chloride | 9 |
| Total PCBs | 20,000 |

**Table 8-3**
**Hybrid Soil Thresholds Concentrations**

| COC | Threshold Concentration (Fg/kg) | Threshold Basis |
|---|---|---|
| Benzo(a)pyrene | 1,600 | 1.0E-6 Acceptable Risk Level from Oregon Environmental Cleanup Rules |
| Field Total HPAHs | 200,000 | Soil volume and mass relationship |
| Field and Lab Total PCBs | 20,000 | EPA Region 10 Superfund Policy and TSCA Rules Risk-based Option |
| Tetrachloroethene (PCE) | 39 | "Highly Mobile" Oregon Hot Spot |
| Trichloroethene (TCE) | 40 | "Highly Mobile" Oregon Hot Spot |
| Vinyl Chloride | 9 | "Highly Mobile" Oregon Hot Spot |

Notes:

COC- Chemicals of Concern

Fg/kg - micrograms per kilogram, or parts per billion

**Table 8-4**
**Thermal Desorber Treatability Study Results for Test Soil 1**

| Contaminant | Remediation Goal (Fg/kg) | Pre-treatment Concentration (Fg/kg) [a] | Pre-treatment Range (Fg/kg) | Post-treatment Concentration (Fg/kg) [a] | Post-treatment Range (Fg/kg) | Percent Reduction % |
|---|---|---|---|---|---|---|
| Benzo(a)anthracene | 2,500 | 8,406 | 2,840 - 24,000 | 35 | 21.7-46.2 | 99.6 |
| Benzo(a)pyrene | 250 | 6,135 | 2,500 - 16,900 | 15 | 8.3 -21.7 | 99.7 |
| Benzo(b)fluoranthene | 2,500 | 10,522 | 4,900 - 23,800 | 94 | 55.9 -129 | 99.1 |
| Benzo(k)fluoranthene | 2,500 | 4,860 | 2,140 - 12,000 | 23 | 12.3 - 33.2 | 99.5 |
| Chrysene | 250,000 | 17,792 | 6,000 - 64,500 | 110 | 69.4 -152 | 99.4 |
| Dibenz(a,h)anthracene | 250 | 885 | 362 - 2,360 | 12 | 4.2 -11.3 | 98.7 |
| Indeno(1,2,3-cd)pyrene | 2,500 | 3,742 | 1,780 - 9,220 | 23 | 11.2 - 34.3 | 99.4 |
| Total PCBs | 1,000 | 1,259 | NA | 40U | 34U-40U | 98.4 |

Notes:

[a] Concentrations presented are mean values

Fg/kg - micrograms per kilogram or parts per billion

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# 9.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The EPA has established nine criteria for the evaluation of remedial alternatives:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

The following subsections evaluate the soil remedial alternatives according to the nine NCP evaluation criteria**.** Costs of the soil alternatives are summarized in **Table 9-1**. Each soil remedial alternative is discussed in terms of the evaluation criteria to help identify a preferred alternative for the Northwest Pipe & Casing Site. The no-action alternative (Alternative S1) was included as a baseline comparison. In each subsection, the order of alternatives discussed is from the least to the most compliance with the criterion.

## 9.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

All alternatives except S1 (no action) meet the threshold criterion of protection of human health and the environment. Alternative S3 (site cap) reduces potential human exposure to site contaminants through a clean soil cap. Alternatives S4A through S4D provide further protection by removing the majority of contaminated soil from the site and isolating remaining contaminated soil under a cap. Alternatives S5A through S-5D offer slightly more protection by removing even more soil while avoiding the need to rely upon engineering controls (site cap) and institutional controls to protect against exposure to contaminants remaining onsite. Alternative S2 affords the most overall protection by removing all soil exceeding remediation goals from the site.

## 9.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

The principal applicable, or relevant and appropriate, criteria or standards (ARARs) driving the remedy selection are the TSCA PCB Remediation Waste Management requirements and the Oregon Environmental Cleanup Rules requirement for maximum acceptable risk levels. All alternatives except S1 (no action) and S3 (site cap) would be designed to meet ARARs. Alternative S3 would not meet the Oregon Environmental Cleanup Rules because it provides no treatment of hot spots of contamination. Alternative S2 actually exceeds ARARS because it removes significantly more soil than otherwise would be needed to meet the maximum acceptable risk levels of Oregon Environmental Cleanup Rules.

## 9.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

There is considerable difference among the alternatives in their ability to provide long-term effectiveness and permanence of protection of human health and the environment over time. Alternative S1 (no action) is not effective in the long term because it is not protective. Alternative S3 (site cap) affords only low long-term effectiveness because there is no reduction of contaminant concentrations through treatment prior to capping and therefore the potential for exposure exists if the cap fails. S3 also does not reduce the potential for soil COCs to leach into groundwater. Alternatives S4A offers slightly more effectiveness and permanence than capping alone, because it remove soil hot spots before capping, but the off-site disposal of hot spot soil in a landfill does not offer significant protection compared to other alternatives providing treatment. S4D (hot spot excavation and off-site treatment and landfill) affords more long term effectiveness because the majority of contaminants are removed from soil through treatment and only a small amount of soil is landfilled. S4B and S4C offer an additional increment of permanence over S4A and S4D because they treat all, rather most, of the excavated hot spot soil. Alternatives S5A through S-5D offer even more long-term effectiveness of protection because they remove more soil beyond hot spots and do not rely upon any additional engineering controls to manage human health risk. Alternative S2 is considered most effective for protection at the site because it removes from the site all soil exceeding the cleanup goals and requires no ongoing operations, maintenance or monitoring after completion.

## 9.4 REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT

Alternative S1 (no action) does not act to reduce contaminant toxicity, mobility and volume of contaminants through treatment. Alternative S3 (site cap) involves no treatment to reduce the toxicity, mobility or volume of wastes. Alternatives S2, S4A, and S5A also rate low because they rely solely on containment (in a landfill) and do not provide for any treatment of contaminated soil to reduce the mobility of contaminants. Alternatives S4B, S4C, S4D include thermal treatment of the majority of excavated contaminated soil as a principal component of the remedy, plus containment of remaining soil under a cap. Alternatives S5B, S5C, S5D also provide for thermal treatment of excavated soil, but rate slightly higher because more of the contaminated soil is excavated and removed from the site than under the respective S4 alternatives.

## 9.5 SHORT-TERM EFFECTIVENESS

Alternative S1 (no action) would not be an effective alternative because current risks from direct contact with contaminated soil would continue to exist. Alternative S2 (excavation and off-site disposal) would require a significant amount of time (estimated at 3-4 years) to implement due to the large quantity of soil to be removed and transported off-site. It would also potentially pose significant impacts to the community, over an extended period of time, associated with soil transportation traffic, and noise and traffic from on-going cleanup operations. Alternatives S4B and S5B (excavation and on-site thermal treatment) would likely have a long implementation time (estimated at 1-3 years) because of mobilization of equipment to the site, test burns and development of operational monitoring requirements. Potential impacts to the community from air and noise emissions and operations of the mobile desorber could occur. Alternatives S4C, S4D, S5C and S5D (off-site thermal desorption) are considered to have similar short-term effectiveness: they could be implemented relatively quicker (1-2 years) than the other alternatives, because a thermal desorption

facility is available locally and has already demonstrated the ability to meet remediation goals through a completed soil treatability study. Of these later four alternatives, S4C and S4D include a soil cap placement after remediation, thus extending the time to completion of the soil remedy; however, S5C and S5D involve excavating and treating a larger quantity of soil, requiring more time to complete. Alternative S3 (site cap) likely could be implemented in the shortest amount of time (estimated at less than 1 year) , since it does not involve movement of contaminated soil, and has minimal short-term impacts on the community.

## 9.6 IMPLEMENTABILITY

Alternative S1 requires no implementation. Alternative S2 (excavation and off-site landfill) is not complicated technically, but due to the significant quantity of soil to be excavated, transported and disposed off-site and the need to import an equivalent amount of clean soil for backfill, it may present administrative complexities to arrange and complete. Alternatives S4B and S5B (excavation and on-site treatment) may be difficult or take longer to implement because they require use of a treatment technology provided by relatively few vendors and may involve lengthy delays due to time needed to mobilize, conduct test burns, coordinate with other governmental entities and set operational conditions. Alternatives S4A and S5A (off-site disposal) involve readily implementable and reliable technologies. Alternatives S4C, S4D, S5C and S5D (excavation and off-site treatment) are readily implementable since there is a thermal desorption facility locally available and a treatability study has been completed. Alternative S3 (cap) is relatively straightforward and equipment and materials are readily available.

## 9.7 COST

The total costs of the soil alternatives developed in the Feasibility Study are summarized in **Table 9-1.** These costs are estimated for purposes of comparison and are considered to be accurate within -30 to +50 percent. The net present value of each alternative is calculated using a discount rate of 5 percent for a period of 30 years.

No costs are associated with Alternative S1. Alternative S3 has the least cost, $2.9 million, of all alternatives which meet the RAOs. Alternatives involving treatment of contamination range from $6.9 million to $11.5 million. Alternatives S4B, S4C and S4D, which excavate and treat Oregon Hot Spots and include a site cap, are less costly than Alternatives S5B, S5C and S5D which remove more soil but exclude a site cap. Costs of the on-site and off-site thermal treatment alternatives (S4B /S4D and S5B/S5D) are roughly comparable to each other for the same quantity of soil handled. Alternative S2, which requires excavation and off-site disposal of all soil exceeding cleanup goals, has the highest cost, estimated at $26.5 million.

## 9.8 STATE ACCEPTANCE

The DEQ has been involved with the development and review of the RI, FS, proposed plan and ROD. The DEQ concurs with the selection of Alternative S4D for the soil operable unit at the Northwest Pipe and Casing Company Superfund site.

## 9.9 COMMUNITY ACCEPTANCE

A responsiveness summary of the comments is provided in Appendix A of this document.

Only a few public comments were submitted during the public comment period and its extension. Comments were supportive of EPA undertaking the soil cleanup. Concerns were expressed by the nearby Hollywood Gardens residential community southeast of the site over the selected remedy's potential to cause heavy truck traffic through or adjacent to their neighborhood. EPA plans to evaluate specific traffic routing alternatives during remedial design and incorporate the community's concerns into the design for the soil remedy.

**Table 9-1**
**Summary of Costs for Soil Remedial Alternatives**

| Alternative | Total Capital Cost ($) | Annual O & M Cost ($) | 30-Year O&M Cost (Present Worth, in $) | Total Present Worth Cost ($) |
|---|---|---|---|---|
| S2: Excavation and Off-site Disposal | 26,500,000 | 0 | 0 | 26,500,000 |
| S3: Site Cap | 2,900,000 | 3,000 | 54,000 | 2,954,000 |
| S4A: Hot Spots Excavation and Off-site Disposal | 6,800,000 | 3,000 | 54,000 | 6,854,000 |
| S4B: Hot Spots Excavation and On-site Thermal Desorption | 6,880,000 | 3,000 | 54,000 | 6,934,000 |
| S4C: Hot Spots Excavation and Off-site Thermal Desorption and Incineration | 10,500,000 | 3,000 | 54,000 | 10,554,000 |
| S4D: Hot Spots Excavation and Off-site Thermal Desorption and Landfill Disposal | 6,700,000 | 3,000 | 54,000 | 6,754,000 |
| S5A: Hybrid Areas Excavation and Off-site Disposal | 7,900,000 | | 0 | 7,900,000 |
| S5B: Hybrid Areas Excavation and On-site Thermal Desorption | 7,500,000 | | 0 | 7,500,000 |
| S5C: Hybrid Areas Excavation and Off-site Thermal Desorption and Incineration | 11,500,000 | | 0 | 11,500,000 |
| S5D: Hybrid Areas Excavation and Off-site Thermal Desorption and Landfill Disposal | 7,700,000 | | 0 | 7,700,000 |

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# 10.0 THE SELECTED REMEDY

## 10.1 SUMMARY OF THE RATIONALE FOR THE SELECTED REMEDY

Based on consideration of the CERCLA requirements and analysis of alternatives using the nine evaluation criteria, including public comment, EPA has determined that the following alternative constitutes the most appropriate remedy for the Northwest Pipe and Casing Company Superfund Site soil operable unit (OU 1):

- Alternative S4D consists of excavating soil exceeding Oregon Hot Spots limits. PAH- and VOC-contaminated soil and soil with PCB concentrations less than 50 mg/kg would be transported to and treated at an off-site thermal desorption treatment facility. Excavated soil with PCB concentrations greater than 50 mg/kg would be transported to an off-site TCSA-compliant RCRA Subtitle C landfill for disposal. Thermally-treated soil would be returned to the site for backfilling. A clean soil cap would be placed on Parcel B. The primary factors in selecting this alternative include providing substantial protection to human health and the environment through treatment of the majority of the principal threat wastes ( the high PAH- and VOC-contaminated soil) to reduce the toxicity, mobility or volume of wastes; safe long-term containment (in a secure landfill) of some of the principal threat wastes (the high PCB- contaminated soil) which are not cost-effective to treat; and secure long-term containment under a cap of the remaining lesser-contaminated soil, in a cost-effective manner.

- Other alternatives considered may: afford a greater degree of human health protection, such as Alternative S5D, by removing a greater quantity of soil from the site; be easier to implement, such as Alternative S3, by not removing any contaminated soil; or provide more long-term effectiveness, such as Alternative S5D, by not relying upon maintenance of a cap for risk reduction. However, Alternative S4D offers the best balance of human health risk reduction and use of treatment to reduce of the toxicity, mobility or volume of hazardous substances, in a cost-effective and readily implementable manner as compared to the other alternatives.

## 10.2 DESCRIPTION OF THE SELECTED SOIL REMEDY

- Site structures and subsurface features will be removed or remain in-place or on-site, as follows:
  - Soil pile 1 (predominantly asphalt) will be buried on-site.
  - Soil piles 2 and 3 will be used as backfill or graded flat, depending on COC concentrations.
  - Soil pile 4 and (drums of) IDW soil will be thermally treated off-site.
  - The aboveground tank containing solidified coal tar and the metal bins containing refuse will be disposed off-site.
  - Underground storage tanks (if any further USTs are located) will be removed for off-site disposal.

- Subsurface piping in areas to be excavated will be removed and disposed off-site.
- The in-ground structure at plant 3 will be left in-place or disposed off-site, based upon the extent of contamination and feasibility of removal.

- All soil with COC concentrations exceeding the Oregon Hot Spot limits as shown below in **Table 10-1** will be excavated and removed from the site. Seven distinct areas of Parcel B exceed one or more of the hot spot threshold concentrations, including primary areas located near Plants 2 and 3 and burial areas 1 and 2. Maximum depth of excavation will be to the water table, approximately 8-9 feet bgs. The total volume of Oregon Hot Spot soil to be removed is estimated at 32,600 cubic yards. Additional soil testing will be conducted during design to verify excavation locations and volumes. Storm water runoff control measures will be taken as necessary during construction activities to minimize adverse impacts to surface waters.

**Table 10-1**
**Criteria for Excavating Soil**

| COC | Threshold Concentration (Fg/kg) |
|---|---|
| Benzo(a)anthracene | 250,000 |
| Benzo(b)fluoranthene | 250,000 |
| Benzo(k)fluoranthene | 250,000 |
| Benzo(a)pyrene | 25,000 |
| Chrysene | 25,000,000 |
| Dibenz(a,h)anthracene | 25,000 |
| Indeno(1,2,3-cd)pyrene | 250,000 |
| Tetrachloroethene (PCE) | 39 |
| Trichloroethene (TCE) | 40 |
| Vinyl Chloride | 9 |
| Total PCBs | 20,000 |

Notes:
COC- Chemicals of Concern
Fg/kg - micrograms per kilogram, or parts per billion

- Excavated soil with less than 50 mg/kg PCB and that is not RCRA characteristic hazardous waste will be transported to an off-site thermal desorption facility for

treatment. Thermally treated soil will be returned to the site and used to backfill the excavated areas, supplemented as necessary with clean fill material. Treated soil will be required to meet the maximum limits for COCs, shown below in **Table 10-2**, before being placed on-site for backfill. An estimated 28,550 cubic yards of excavated soil will be thermally treated off-site.

**Table 10-2**
**Maximum Limits for COCs in Treated Soil**

| COC | MAXIMUM CONCENTRATION |
|---|---|
| Benzo(a)anthracene | 2,500 Fg/kg |
| Benzo(b)fluoranthene | 2,500 Fg/kg |
| Benzo(k)fluoranthene | 2,500 Fg/kg |
| Benzo(a)pyrene | 250 Fg/kg |
| Chrysene | 250,000 Fg/kg |
| Dibenz(a,h)anthracene | 250 Fg/kg |
| Indeno(1,2,3-cd)pyrene | 2,500 Fg/kg |
| Total PCBs | 1 mg/kg |
| Tetrachloroethene (PCE) | 7 Fg/kg |
| Trichloroethene (TCE) | 13 Fg/kg |
| Vinyl Chloride | 0.1 Fg/kg |

Notes:
COC- Chemicals of Concern
Fg/kg - micrograms per kilogram, or parts per billion

- Excavated soil with total PCBs concentrations exceeding 50 mg/kg, the allowable limits of the thermal desorption facility's permit, will be transported to and disposed in an off-site TSCA-compliant RCRA Subtitle C landfill. An estimated 4,050 cubic yards of excavated soil will be landfilled off-site.

- An Area of Contamination (AOC), encompassing all of Parcel B, is designated by this ROD. Soil which exhibits the RCRA TCLP characteristic for PCE will be treated in the AOC until it no longer fails the TCLP characteristic, prior to land disposal. An estimated 120 cy of excavated soil in the vicinity of Plant 3 and a presently-undetermined quantity of PCE- contaminated soil from other areas of Parcel B may exhibit the RCRA TCLP characteristic for PCE. The AOC designated for the Northwest Pipe and Casing Company site is shown in **Figure 10-1.** Pursuant to EPA policy, because an AOC is equated to a RCRA land-based unit, consolidation

and *in situ* treatment of hazardous waste within the AOC do not create a new point of hazardous waste generation for purposes of RCRA. Therefore, soil within the AOC may be consolidated or treated *in-situ* without triggering RCRA land disposal restrictions (LDRs) or minimum technology requirements.

- Security patrols of Parcel B will be continued until the site cap is completed. Security personnel will be required to meet appropriate personal protection and safety requirements.

- A two-foot cap of clean soil will be placed on Parcel B and graded to an acceptable contour. The cap will be revegetated. The soil cap will be constructed after the soil excavation and backfilling are completed, unless EPA determines that construction of the groundwater remedy would compromise or interfere with the cap. In the later case, the cap placement may be delayed until after the groundwater remedy construction is completed. A storm water management system for Parcel B will be evaluated after cap placement, and constructed if needed.

- A long-term monitoring and maintenance program will be developed and implemented for the Parcel B soil cap.

- Institutional controls to limit and manage human exposure to remaining contaminated soil underneath the cap on Parcel B will be obtained. The Oregon DEQ presently holds title to Parcel B. A sale of Parcel B requires EPA approval. Therefore, EPA expects that obtaining institutional controls will not be a problem. These will consist of deed restrictions, and/or restrictive covenants, security fencing and warning signs (while the site is vacant), to warn of the subsurface soil contaminant hazards, ensure the integrity of the soil cap and limit and manage land uses and activities which could compromise the cap's protectiveness. As long as DEQ has ownership of Parcel B, DEQ will be the enforcing agency for institutional controls and will limit uses of Parcel B to those compatible with the local land use authority's designation and which will not result in unacceptable exposure to site contaminants. At such time as DEQ, with EPA approval, sells or otherwise transfers ownership of Parcel B, EPA expects that the institutional controls will transfer with title and run with the land. EPA and DEQ desire to return Parcel B to productive reuse. Prospective purchaser agreements may be used by DEQ and EPA to limit the future liability of a prospective purchaser for past releases of hazardous substances. Construction and maintenance workers on Parcel B will be advised of the soil contaminant hazards and appropriate protective measures to be taken.

- If the Plume 4 source area investigation of Parcel A identifies contaminated soil with COC concentrations exceeding the VOC hot spot levels, EPA expects to remediate this soil using the remedy selected in this ROD, if practicable.

- In evaluating transportation routes for site ingress and egress during construction of the selected remedy, EPA will consider the comments and views of the local community and will seek to minimize or avoid increased truck traffic through residential areas in the site's vicinity.

## 10.3 EXPECTED OUTCOMES OF THE SELECTED SOIL REMEDY

This section presents the expected outcomes of the selected remedy in terms of resulting land uses and risk reduction achieved as a result of the selected response action.

- Following completion of the soil remedy, Parcel B will be able to be used for commercial/light industrial purposes, which are the current and reasonably likely future land uses. While the site is awaiting redevelopment, trespassers on the site will not be subject to unacceptable health risks from exposure to site soil.

  Future residential use of Parcel B would not be appropriate because the remediation goals for soil at the site were not based on a residential land use scenario. Institutional controls will provide a mechanism for DEQ to ensure as necessary that site uses and activities over time will be compatible with the protectiveness of the remedy. Provisions for periodic inspections and maintenance of the soil cap will be necessary. If ownership of Parcel B is transferred from DEQ at a future date, these land use restrictions and cap maintenance provisions will be binding on subsequent owners.

- After completion of the soil remedy, human health risks posed by soil at the site will be significantly reduced. Human health risk to the transient trespasser will be reduced by two orders of magnitude, and human health risks to future on-site construction workers and maintenance workers will be reduced by one order of magnitude. Construction and maintenance workers at the site will be able to conduct normal working activities with proper safety measures without being exposed to unacceptable health risks due to soil contamination.

- Cleanup levels for soil chemicals of concern (COCs) are presented in **Table 10-3**. Cleanup levels for the individual HPAHs in soil were selected to correspond to an excess lifetime cancer risk of $1 \times 10^{-6}$ from direct contact with contaminated soils by trespassers, construction workers and maintenance workers. Cleanup levels for PCE, TCE and vinyl chloride in soil were selected to be protective of groundwater used in the future for drinking water by an off-site resident. The cleanup levels correspond to an excess lifetime cancer risk of $1 \times 10^{-6}$ from direct contact and ingestion of groundwater. Since hot spot removal will not remove all soil on-site with COCs above the cleanup levels, the selected remedy includes construction of a clean soil cap and placement of institutional controls to limit exposure to remaining COCs.

- Selection of the PCB remedy is based upon both the NCP nine criteria and the TSCA Remediation Waste Risk-Based Disposal Approval at 40 CFR 761.61(c). The remedy consists of removal of principal-threat PCB wastes from the site, placing a clean soil cap over the site, and implementing institutional controls to limit exposure to PCBs in remaining soil. The selected remedy for PCBs meets the TSCA regulatory requirement that the risk-based method for disposal of PCB remediation waste will not pose an unreasonable risk of injury to health and the environment. This has been

demonstrated through the NCP nine criteria analysis which includes a threshold criteria for overall protection of human health and the environment as well as consideration of both short-term and long-term protectiveness. The current and future land use of the site is industrial and/or commercial. The remedy will result in an excess cancer risk of no greater than
$1 \times 10^{-6}$ and therefore will not pose an unreasonable risk of injury to human health. Also, the selected remedy will also not pose an unreasonable risk of injury to the environment because the CERCLA risk analysis shows that ecological receptors of concern are not expected to experience significant adverse impacts from current site conditions.

**Table 10-3**
**Soil Cleanup Levels for COCs**

| COC | SOIL CLEANUP LEVEL |
|---|---|
| Benzo(a)anthracene | 2,500 Fg/kg |
| Benzo(b)fluoranthene | 2,500 Fg/kg |
| Benzo(k)fluoranthene | 2,500 Fg/kg |
| Benzo(a)pyrene | 250 Fg/kg |
| Chrysene | 250,000 Fg/kg |
| Dibenz(a,h)anthracene | 250 Fg/kg |
| Indeno(1,2,3-cd)pyrene | 2,500 Fg/kg |
| Total PCBs | 1 mg/kg |
| Tetrachloroethene (PCE) | 7 Fg/kg |
| Trichloroethene (TCE) | 13 Fg/kg |
| Vinyl Chloride | 0.1 Fg/kg |

Notes:
COC- Chemicals of Concern
Fg/kg - micrograms per kilogram, or parts per billion

## 10.4 SUMMARY OF THE ESTIMATED SOIL REMEDY COSTS

Estimated costs of the selected soil remedy are presented below in **Table 10-4.** Present worth O&M is based on a 5% discount factor for a period of 30 years. The cost estimate is accurate to between +50 percent and -30 percent.

**Table 10-4**
**Cost Estimate Summary for the Selected Soil Remedy**

| Item | Units | Quantity | Unit Cost | Cost |
|---|---|---|---|---|
| Mobilization | | | | |
| Mobilize equipment | LS | 1 | $40,000 | $40,000 |
| Feature Removal | | | | |
| Soil pile 4 dispose off-site | CY | 2,100 | $33 | $70,000 |
| Soil pile 2 grade flat | CY | 1,850 | $2 | $3,700 |
| Soil pile 3 grade flat | CY | 6,000 | $2 | $12,000 |
| Soil piles debris dispose off-site | TON | 700 | $40 | $28,000 |
| Asphalt pile 1 burial | CY | 750 | $7 | $5,250 |
| Coal tar tank off-site disposal | EA | 1 | $7,000 | $7,000 |
| Metal bins off-site disposal | EA | 2 | $1,000 | $2,000 |
| Parcel B USTs removal | EA | 5 | $5,000 | $25,000 |
| Concrete foundation/debris burial | LS | 1 | $20,000 | $20,000 |
| In-ground structure disposal | EA | 1 | $17,000 | $17,000 |
| Drains | EA | 4 | $1,000 | $4,000 |
| Sub-surface piping | LS | 1 | $5,000 | $5,000 |
| Improve drainage channels as needed | LS | 1 | $10,000 | $10,000 |
| Railroad ties and track | LS | 1 | $2,000 | $2,000 |
| Treat IDW soil off-site | TON | 50 | $50 | $2,500 |
| Treatment | | | | |
| Excavation | CY | 32,600 | $5 | $163,000 |
| Dewatering | EA | 2 | $5,000 | $10,000 |
| Transport to thermal desorber | TON | 42,285 | $6 | $256,950 |
| Thermal desorption | TON | 42,285 | $32 | $1,370,400 |
| On-site PCE treatment | CY | 120 | $35 | $4,200 |
| Sampling | samples | 163 | $60 | $9,780 |
| Disposal | | | | |
| Transportation to landfill | TON | 8,475 | $10 | $84,750 |
| Subtitle D disposal of excavated debris | TON | 2,400 | $30 | $72,000 |
| Subtitle C landfill disposal | TON | 6,075 | $150 | $911,250 |
| Backfilling | | | | |
| Transport treated soil back to site | TON | 42,825 | $6 | $256,950 |
| Purchase backfill | TON | 8,475 | $5 | $42,375 |
| Transport clean backfill | TON | 8,475 | $4 | $29,663 |
| Place and compact | CY | 32,600 | $4 | $130,400 |
| Capping | | | | |
| Cover soil | TON | 155,000 | $7 | $1,085,000 |
| Soil transport | TON | 155,000 | $4 | $542,500 |
| Place and compact | CY | 103,000 | $4 | $412,000 |
| Hydroseed | acres | 32 | $2,500 | $80,000 |
| Annual O&M | | | | |

**Table 10-4 (cont.)**
**Cost Estimate Summary for the Selected Soil Remedy**

| Item | Units | Quantity | Unit Cost | Cost |
|---|---|---|---|---|
| Annual Inspection/Monitoring | YEAR | 30 | $3,000 | $46,117 |
| | | | | |
| Subtotal Capital Costs | | | | $5,714,668 |
| Engineering Expenses | % | 7 | | $400,027 |
| Contingency | % | 10 | | $571,467 |
| **TOTAL CAPITAL COSTS** | | | | **$6,686,161** |
| | | | | |
| Subtotal O&M Costs | | | | $46,117 |
| Engineering Expenses | % | 7 | | $3,228 |
| Contingency Allowances | % | 10 | | $4,612 |
| **PRESENT WORTH O&M COSTS** | | | | **$53,957** |
| | | | | |
| **TOTAL PRESENT WORTH VALUE** | | | | **$6,740,000** |

# 11.0 STATUTORY DETERMINATIONS

Under CERCLA, selected remedies must protect human health and the environment, comply with ARARs, be cost-effective and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Additionally, CERCLA includes a preference for remedies that use treatment to significantly and permanently reduce the volume, toxicity or mobility of hazardous wastes, as their principal element. The following sections discuss how the selected soil remedy for the Northwest Pipe and Casing Company site OU 1 meets these statutory requirements.

## 11.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected soil remedy will protect human health and the environment by:

- Removing COC-contaminated surface and subsurface soil from the site
- Treating most of the excavated soil to permanently remove COCs from the soil
- Preventing direct contact, including ingestion, dermal contact and inhalation of particulates, with soil containing COCs above health-based levels
- Reducing the COCs in soil available for partitioning to groundwater.

These elements of the remedy will prevent access to soil COCs where they are present: remove hot spots of contaminated soil at current and future points of exposure, and treat COCs in most of the areas of highest concentration in soil. COCs will be removed from soil until levels meet excavation criteria. Inspection and maintenance of the soil cap and implementation of institutional controls will help assure the on-going protectiveness of the remedy by protecting the cap integrity and limiting exposure to COCs in remaining soil.

Implementation of the selected remedy is not expected to pose unacceptable short-term risks or significant cross-media impacts.

## 11.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The selected soil remedy for the Northwest Pipe and Casing Company Superfund site will comply with federal and state ARARs that have been identified. No waiver of any ARAR is being sought or invoked for the selected soil remedy. Where a state ARAR is equivalent or more stringent than a corresponding federal ARAR, only the state ARAR is identified. The chemical-, action-, and location-specific ARARs identified for the site follow.

**Oregon Environmental Cleanup Rules (OAR 340-122)** is applicable for the establishment of cleanup levels and selection of remedial actions for soil. OAR 340-122-040(2) requires that hazardous substance remedial actions achieve one of four standards: a) acceptable risk levels, b) generic soil numeric cleanup levels, c) remedy-specific cleanup levels provided by ODEQ as part

of an approved generic remedy, or d) background levels in areas where hazardous substances occur naturally. The risk-based cleanup levels under OAR 340-122-040(2)(a) above are applicable for the soil at the Northwest Pipe and Casing Company site due to the complexity of the site.

OAR 340-122-115 defines the following maximum acceptable risk levels:

- 1.0E-6 for individual carcinogens
- 1.0E-5 for multiple carcinogens, and
- a Hazard Index of 1.0 for noncarcinogens

These acceptable risk levels were used as a basis to establish soil remediation goals (RGs) for the site, taking into account the current and reasonably likely future land use, as presented in **Table 7-1.** These RGs are applicable to soil at the site where COC concentrations in soil exceed the RGs and will be achieved through a combination of soil hot spots removal, a site cap and institutional controls.

OAR 340-122-085(7) requires that, for hot spots of contamination in media other than groundwater or surface water, the feasibility of treatment be evaluated. OAR 340-122-090(1) provides that a remedial action selected shall treat hot spots of contamination to the extent feasible. The Northwest Pipe and Casing Company site contains hot spots of soil contamination as defined by OAR 340-122 and therefore the selected soil remedy will provide for treatment of soil hot spots to the extent feasible.

OAR 340-122 is applicable to the removal or abandonment of underground storage tanks (USTs) on Parcel B. Two USTs and adjacent petroleum-contaminated soil were removed from Parcel in December 1998. No additional USTs were confirmed during the RI to be present on Parcel B, but may be present based on information from former employees. If additional USTs are identified during implementation of the selected remedy, removal will be performed in accordance with OAR 340-122.

**Oregon Solid Waste Management Rules (OAR 340-093 through -097)** are applicable to the treatment and disposal of solid waste from the Northwest Pipe and Casing Company site. Section 340 093-0170 is applicable to the disposal of cleanup materials contaminated with hazardous substances that are not in themselves hazardous substances, such as petroleum contaminated soil. Such material must be disposed only in landfills meeting the RCRA Subpart D design criteria and that have been authorized to receive this type of material by DEQ. Section 340 093-0190 is applicable to the disposal of special wastes, including construction and demolition debris and oil wastes. Solidified coal tar and construction and demolition wastes from the Northwest Pipe and Casing Company site will be disposed in a landfill approved for handling such special wastes.

**Oregon Hazardous Wastes Management Rules (OAR 340-100 through -120)** are applicable to soil at the site which exhibits a characteristic of hazardous wastes. Based on the RI data and history of past facility operations, soil at the site does not contain state-only or listed hazardous wastes. However, some soil at the site may exceed the Toxicity Characteristic Leaching Procedure (TCLP) concentration of 0.7 mg/L of PCE and therefore exhibit the toxicity characteristic for PCE. This determination is made on the basis that subsurface soil in the vicinity of Plant 3 contained PCE

levels as high as 370 mg/kg and PCE is known to preferentially leach from soil to water. TCLP tests on soil at the site were not conducted during the RI. EPA will conduct additional tests on the suspected soil to verify the TCLP presumption prior to implementing the selected remedy. Approximately 120 cubic yards of PCE-contaminated soil at the site may exceed the TCLP level for PCE.

EPA plans to treat soil exhibiting the RCRA TCLP characteristic for PCE in an on-site Area of Contamination (AOC) designated by this ROD, until the soil is no longer TCLP characteristic for PCE. RCRA requirements are not ARARs for consolidation or *in-situ* treatment conducted in an AOC.

The state of Oregon has adopted the RCRA Land Disposal Restrictions (40 CFR Part 268), which is an ARAR for *ex-situ* or off-site treatment of soil exhibiting a hazardous waste characteristic, prior to land disposal. *Ex-situ* or off-site treatment of TCLP soil may be used if *in-situ* treatment within the on-site AOC is not successful or feasible. In this case, the LDR treatment standards would have to be met. RCRA TCLP waste sent off-site will comply with the Oregon RCRA rules pertaining to the generation, transportation and treatment, storage and disposal of hazardous waste.

**TSCA Regulations for PCB Remediation Wastes Management (40 CFR 761.61)** are applicable to the selection of the remediation goal for PCBs in soil at the site and to the management of soil exceeding the remediation goal, i.e, the selected remedy. TSCA Remediation Waste Risk-Based Disposal Approval at 40 CFR 761.61(c) provides for use of a risk-based method for disposal of PCB remediation waste if it will not pose an unreasonable risk of injury to health and the environment. As discussed in Section 7.2.1, EPA has determined that the selected remedy will not pose an unreasonable risk of injury to health and the environment.

**Oregon General Emission Standards for Particulate Matter (OAR 340-208-0100 through -0210)** is applicable visible emissions and nuisance conditions from the selected soil remedy. The Northwest Pipe and Casing Company site is located in a designated Special Control Area. Consequently, dust generated from earthwork or other disturbance of on-site soils must meet a nuisance condition standard for fugitive emissions traceable directly to a specific source. In addition, opacity and particulate matter concentration standards are applicable to vehicle emissions on-site.

**Oregon Water Quality Management Plan (OAR 340-041 and -045)** is applicable to the management of storm water runoff from the site. Water quality criteria in the Williamette Basin (location of the Northwest Pipe and Casing Company site) not to be exceeded are specified for dissolved oxygen, temperature, turbidity, pH, bacteria, radioisotope concentrations and total dissolved solids. Construction activities associated with the selected soil remedy will comply with OAR 340-041.

**Endangered Species Act of 1973 as amended (16 U.S.C. 1531 et seq)** is applicable to construction of the selected soil remedy. Federal agencies are required to consult with the appropriate Service when an activity authorized, funded or carried out by that agency may affect a listed species of concern or designated critical habitat.

The National Marine Fisheries Service (NMFS) has listed as either threatened or endangered several anadromous fish including: Lower Columbia River steelhead (*Onchorynchus mykiss*), Lower Columbia River/Southwest Washington coho salmon (*Onchorynchus kisutch* ), Lower Columbia River/Southwest Washington cutthroat trout ( *Onchorynchus clark clarki*) and the Columbia River bull trout (*Salvelinus confluentus*). The designated critical habitats of these species include Dean Creek and Mt. Scott downstream from the Northwest Pipe and Casing Company site.

EPA has determined that implementation of the selected soil remedy is not likely to adversely affect these listed species or their designated critical habitat. EPA's determination is based on the inclusion of erosion control measures in the soil remedy to minimize degradation of downstream surface water quality and aquatic habitat.

For the Northwest Pipe and Casing Company Superfund Site, EPA has conducted an informal consultation with the National Marine Fisheries Service (NMFS) concerning the selected soil remedy. The NMFS has concurred with EPA's determination of no adverse effects. NMFS concurrence completes the informal consultation process. No formal consultation is required.

## 11.3 OTHER CRITERIA, ADVISORIES OR GUIDANCE

This section discusses other criteria, advisories, or guidance considered to be appropriate for the selected soil remedy for the Northwest Pipe and Casing Company Superfund site.

The *State of Oregon Best Management Practices (BMPs) for Storm Water Discharges Associated With Construction Activities* will be considered during design of the selected soil remedy.

## 11.4 COST-EFFECTIVENESS

The selected soil remedy for the Northwest Pipe and Casing Company Superfund site is one of the least costly alternatives evaluated for the soil operable unit. Taking no action to remediate soil would be considerably less costly than the selected remedy, but would not be protective of human health and the environment. Capping Parcel B without any prior soil removal or treatment also would be less costly than the selected remedy , but may not be protective of human health and the environment due to continued leaching of soil VOCs to groundwater and would not reduce the volume or toxicity of contaminants in the soil. On-site thermal desorption is generally comparable in cost to the selected soil remedy, but would be more difficult and take a longer period of time to implement. All other soil remedial alternatives evaluated are more costly than the selected soil remedy.

The selected soil remedy is cost-effective because it is protective of human health and the environment, attains ARARs, and its effectiveness in meeting the remedial action objectives is proportional to its cost.

## 11.5 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected soil remedy for the Northwest Pipe and Casing Company Superfund Site represents the maximum extent to which permanent solutions and treatment can be utilized in a cost-effective manner. It is protective of human health and the environment, complies with ARARs, and provides the best balance of tradeoffs in terms of long-term effectiveness, permanence, short-term effectiveness, implementability, cost, and reductions in toxicity, mobility or volume of hazardous substances. The selected soil remedy meets the statutory requirements for using permanent solutions to the maximum extent practicable. All of the action alternatives for soil were found to achieve comparable overall protection of human health and the environment and to be effective. Therefore, the alternative considered to be least costly while utilizing permanent solutions was selected. The most-highly PCB contaminated soil (greater than 50 mg/kg) will be disposed in a TSCA-compliant landfill rather than incinerated because the significant cost of incineration (almost $3 million or 50 percent more than the selected remedy) is not proportional to the additional public health protection provided.

Reuse of thermally treated soil for backfilling excavations at the site represents use of resource recovery technologies to the maximum extent practicable at the Northwest Pipe and Casing Superfund Site. Recyclable materials including scrap metal, discarded automotive batteries and tires were removed from the site during the RI and recycled locally. The soil remedy will not recover any contaminant in significant quantity or in a pure form so as to allow reuse of the contaminant as a resource.

## 11.6 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected soil remedy for the Northwest Pipe and Casing Superfund Site includes the following treatment elements to address the principal threat wastes:

- Thermal desorption of the majority of the most highly contaminated (hot spots) soil, which removes contaminants from the soil

- Treatment, by on-site soil vapor extraction or other practical method, of PCE-contaminated soil exhibiting the RCRA TCLP characteristic, which removes volatile contaminants from the soil

## 11.7 FIVE-YEAR REVIEW REQUIREMENTS

The Five-Year Review is required pursuant to CERCLA Section 121(c) and the NCP Part 300.430 (f)(5)(iii)(C) because the selected soil remedy will result in HPAH and PCB levels in soil at levels that do not allow for unlimited and unrestricted exposure throughout the site. The Five-Year Reviews will evaluate whether the soil remedy will remain protective of human health and the environment into the future. The first Five-Year Review will be conducted no later than 5 years after the initiation of the soil Remedial Action. Five-Year Reviews will be conducted thereafter.

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## 12.0DOCUMENTATION OF SIGNIFICANT CHANGES

The proposed plan for the soil operable unit released for public comment on January 30, 2000, presented remedial action alternatives for the Northwest Pipe and Casing Superfund Site. The proposed plan identified the preferred soil alternative as Alternative S4D. EPA reviewed all written and oral comments submitted during the public comment period. The comments generally expressed support for the EPA preferred alternative. However, several residents expressed concerns about the amount of heavy truck traffic that would enter and exit the site, during cleanup, through the nearby residential community known as Hollywood Gardens. The commenters apparently assumed that trucks would enter and exit the site using Clackamas Road, which runs adjacent to the Hollywood Gardens area southeast of the site . However, EPA did not evaluate possible modes or routes for site ingress and egress in the proposed plan, and no particular transportation route or mode was specified in the proposed plan. If trucks are used, several roads are potentially available, including Clackamas Road and Lawnfield Road, which accesses the site from the north and away from Hollywood Gardens area. Railroad access to the site also exists along the western property line of Parcel B, although a railroad spur into the site was dismantled during the RI.

During the remedial design phase of the soil remedy, EPA will evaluate the possible modes and routes for transporting contaminated and clean soil and for overall site ingress and egress. EPA will seek to select transportation arrangements to/from the site which minimize or avoid increased truck traffic through the Hollywood Gardens area. EPA will keep the community advised of specific site ingress/egress plans.

The selected remedy includes the designation of Parcel B as an Area of Contamination (AOC) for the purposes of consolidating or treating *in-situ* the on-site soil which may exhibit the RCRA TCLP characteristic for PCE. The proposed plan did not designate an AOC because it specified *ex-situ* treatment for this soil. Designating an AOC provides additional flexibility in conducting the on-site treatment, by allowing consolidation and *in-situ* treatment without triggering the RCRA land disposal regulations.

No other significant changes were necessary to the soil remedy for the Northwest Pipe and Casing Superfund Site, as it was originally identified in the proposed plan, and to satisfy public concerns.

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# APPENDIX A

## Responsiveness Summary

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# APPENDIX A
# RESPONSIVENESS SUMMARY

The responsiveness summary addresses public comments on the proposed plan for soil remedial action at the Northwest Pipe and Casing Superfund Site. The proposed plan was issued on January 30, 2000. The public comment period was held from January 30, 2000 to March 31, 2000, including a 30-day extension. A public hearing was held on February 8, 2000 to present the proposed plan and to accept oral and written public comments.

## SUMMARIZED COMMUNITY CONCERNS

**Comment:** *We support the proposed site cleanup but have major concerns with EPA's plan to egress the site using already overburdened roads through the residential community known as Hollywood Gardens. The existing roads were originally designed to handle residential traffic. Heavy truck traffic has become a daily hazard, due to the commercial businesses off of Clackamas Road. Increased truck traffic is a danger to local school bus drops and pick ups. We request that EPA look at possible alternative routes to enter and exit the proposed clean up site.*

**Response:** The Feasibility Study did not evaluate different truck routes for transporting soil to the off-site thermal treatment facility and treated soil back to the site. Consequently, in the proposed plan EPA did not designate a preferred routing for transporting contaminated and clean soil and for overall site ingress and egress of vehicles. However, there are at least two possible site ingress/egress points for trucks, to the south along Mather road connecting to Clackamas Road, and to the north via Lawnfield Road. The Mather Road/Clackamas Road route borders the Hollywood Gardens residential community, as noted by the commenter.

During remedial design of the selected soil remedy EPA will evaluate possible truck transportation routes. Railroad transportation will be considered also, since the Southern Pacific Railroad tracks are adjacent to the west boundary of the site. EPA will consult with the local community planning organizations during remedial design on ways to avoid or mitigate adverse impacts associated with increased truck traffic. EPA will seek to select transportation arrangements to/from the site during cleanup which minimize or avoid increased truck traffic through the Hollywood Gardens area.

**Comment:** *Is there upstream TCE contamination? What is its source and what steps will be taken for cleanup?*

**Response:** The commenter presumably is referring to TCE contamination of groundwater. TCE and PCE were detected in the upper aquifer groundwater at the southeast corner of Parcel B, which is likely the most upgradient point of the upper aquifer on the site. EPA believes the TCE and PCE in groundwater at this location likely originated in the vicinity of this location on Parcel B, rather than from an off-site source, because three upgradient groundwater monitoring locations to the south of Mather Road did not detect TCE.

DEQ has advised EPA of several environmental investigations occurring with DEQ oversight at properties to the south and east of the Northwest Pipe and Casing Company site. EPA will monitor these investigations for potentially useful information.

**Comment:** *Would EPA actually consider leaving contamination on the Northwest Pipe and Casing Company site and growing a grass cover on top?*

**Response:** Alternative S3 would leave all soil contamination in place and cover the site with a 2-foot thick soil cap revegetated to control erosion. Although this alternative would significantly reduce human exposure to the soil contaminants by a soil cap and institutional controls, it may not be protective of human health and the environment because it may not reduce the leaching of soil contaminants to groundwater. Alternative S3 was not preferred by EPA in the proposed plan and was not selected as the soil remedy because it would not result in any permanent reduction in the toxicity, mobility or volume of soil contamination and may not be fully protective of human health and the environment.

**Comment:** *What kind of protection do cleanup workers have?*

**Response:** Provisions for worker personnel protection and safety at Superfund sites are included in a site-specific Health and Safety Plan. The Northwest Pipe and Casing Company Health and Safety Plan, prepared for the remedial investigation, will be updated and revised prior to implementing the selected soil remedy. The Safety and Health Plan requires cleanup workers to wear protective clothing appropriate to the site conditions and follow safe operating procedures and practices. Cleanup workers also participate in a medical monitoring program. Oregon OSHA regulations also provide for protective measures for worker safety.

**Comment:** *If the site is not cleaned up, how would future contractors working at the site become aware of the soil contamination?*

**Response:** Under the no action alternative S1, there would be no actions taken to reduce human health risks from the site. This would include no actions to notify workers of contamination at the site. EPA did not select the no action alternative because it clearly is not protective of human health for the expected future land use.

The selected soil remedy includes institutional controls to warn prospective construction and maintenance workers of the hazards associated with the remaining soil contaminants. The property owner of Parcel B will be responsible to provide such notice to workers.

**Comment:** *Did Northwest Pipe and Casing Company make pipe at this site? If so, wouldn't one expect more metals contamination?*

**Response:** Northwest Pipe and Casing Company manufactured steel pipe on the western lot of Parcel A for approximately 18 years. It is likely that metal scraps from pipe manufacturing and milling were disposed on both Parcels A and B. Scraps of metal pipe, metal cuttings and fragments of metal were observed in a number of the soil test pits dug during the remedial investigation. Metals, such as iron, chromium, beryllium and nickel were detected at relatively low levels in soil samples from Parcels A and B. Groundwater also contained dissolved arsenic, iron, lead and

manganese. The occurrence and concentrations of metals detected in the soil and groundwater at the Northwest Pipe and Casing Company site would appear to be consistent with the known manufacturing activities which took place.

**Comment:** *Will there be additional testing of soils and groundwater beneath the existing buildings prior to cleanup?*

**Response:** EPA does not plan to conduct additional testing of soil beneath former or existing buildings prior to cleanup. All buildings on Parcel B have been demolished and removed. Concrete pads and foundations remain at the former locations of Plants 1, 2, 3 and 4. The selected soil remedy includes breaking up the concrete pads and burying them on-site. EPA does not have any reason to suspect that the former plants on Parcel B were constructed over already-contaminated soil or that plant operations led to releases of COCs directly to soil beneath the plant foundations. Also, soil under the concrete pads would not be expected to be significantly contaminated with COCs because the concrete pads would have prevented spills and releases of chemicals from seeping into underlying soil. However, if visual observation of the soil underlying concrete pads suggests contamination, soil testing for COCs will be conducted.

Parcel A contains several existing buildings owned by ODOT and Northwest Development Company. Soil underneath the existing buildings on Parcel A is not expected to be contaminated. These buildings have concrete pads and foundations. Prior to construction of the commercial buildings on the eastern lot of Parcel A, the lot was used for storing pipe and would not be expected to have any significant soil contamination. This was confirmed by the limited soil sampling on the eastern lot of Parcel A during the RI. The ODOT building on the western lot of Parcel A was the former Northwest Pipe and Casing Company pipe manufacturing plant. EPA is not aware of any plant processes which would have led to releases of COCs directly to the soil beneath the concrete floor.

Further soil and groundwater testing at the site will be conducted by EPA to complete characterization of the nature and extent of groundwater contamination and attempt to locate the source area for groundwater contamination Plume 4 on Parcel A. Sampling locations have not yet been identified: however, the presence of concrete pads over desired sampling locations is not expected to prevent sampling from occurring.

**Comment:** *EPA's preferred alternative for soil is compatible with Oregon Department of Transportation plans for the Sunrise Corridor highway project. Most of the new expressway and local roads would be constructed above grade and therefore would not disturb the proposed soil cap. The expressway may require a creek culvert, which would require excavation. New local roads would need storm drains which may require excavations. ODOT will handle excavated material from site areas not cleaned up as contaminated soil.*

**Response:** EPA notes the comments from ODOT. EPA will continue to keep ODOT informed of progress of the soil remedy and coordinate with ODOT as needed. Institutional controls will be implemented to limit and manage human exposure to remaining contaminated soil underneath the cap on Parcel B. ODOT activities on Parcel B will need to be compliant with the institutional controls.

**Comment:** *ODOT has identified several wetlands on the Superfund site which would be filled by the Sunrise Corridor project or as part of EPA's cleanup plan if the cleanup occurs before the highway project. ODOT would like to work with EPA to identify potential mitigation sites.*

**Response:** EPA conducted a wetlands identification survey of Parcel B during the remedial investigation. Results of the survey are included in Appendix E of the *Human Health and Ecological Risk Assessment Baseline Report, dated August 1998.* The wetlands survey divided Parcel B into seven areas and then evaluated the vegetative cover, hydrology characteristics and soil characteristics of each area. The survey concluded that no areas of Parcel B met the definition of wetlands as detailed in the U.S. Army Corps of Engineers Wetlands Delineation Manual. Since no wetlands were observed on Parcel B, a wetland functional assessment was not conducted. A wetlands survey of Parcel A was not performed because the parcel has extensive commercial and industrial development.

**Comment:**. *EPA's soil cleanup plan should not depend on the Sunrise Corridor project as providing the cap for the site because ODOT currently does not have funding for the expressway project. The Sunrise Corridor Project may be more than a decade away from implementation*.

**Response:** The selected soil remedy does not assume that the Sunrise Corridor highway project will provide part of the capping for Parcel B; however, EPA would be open to considering this as a possibility. Construction of the soil cap specified by EPA's selected remedy will be coordinated with EPA's selection of a remedy for the groundwater operable unit and with any development plans proposed for the site so that the cap integrity is not compromised by these activities. Parcel B cap construction is expected to proceed no later than 1 to 2 years after completion of the construction of a groundwater remedy. EPA expects to issue a ROD for the groundwater operable unit in 2001.